Registered at the G.P.O. for Transmission to Canada and Newfoundland by Magazine Post.

VOL. 33. Ser. A. Part 4. pp. 97–128. APRIL, 1945.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

Price 3s. net.

All Rights Reserved.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Executive Council.

G. H. CREASY, C.M.G., O.B.E., *Chairman*, Colonies, Protectorates and Mandated Territories.
Lieutenant-Colonel J. G. ROBERTSON, *Vice-Chairman*, Canada.
Sir DONALD FERGUSSON, K.C.B., United Kingdom.
F. L. McDOUGALL, C.M.G., Australia.
A. L. POOLE, New Zealand.
A. P. VAN DER POST, Union of South Africa.
J. W. DULANTY, C.B., C.B.E., High Commissioner, Eire.
D. JAMES DAVIES, C.B.E., Newfoundland.
Sir DAVID B. MEEK, C.I.E., O.B.E., India.
B. O. BINNS, O.B.E., Burma.
W. C. ROBERTSON, Southern Rhodesia.
Sir DAVID CHADWICK, K.C.M.G., C.S.I., C.I.E., *Secretary*.

Director and Editor.

S. A. NEAVE, C.M.G., O.B.E., D.Sc.

Assistant Director.

W. J. HALL, M.C., D.Sc.

Assistant Editor.

H. S. BUSHELL, M.A.

Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office and Library—41, Queen's Gate, London, S.W.7.

Director, Imperial Parasite Service.

W. R. THOMPSON, D.Sc., F.R.S.

228, Dundas Street, Belleville, Ontario, Canada.

REVISTA DE ENTOMOLOGIA

An International Review of Entomology

An illustrated magazine published four times a year by **THOMAZ BORGMEIER, O.F.M.,** devoted to entomology, mainly of the neotropical fauna.

The volumes already published since 1931 comprise thousands of pages and contain articles by leading entomologists, such as F. W. Edwards, W. Horn, E. Lindner, J. W. S. Macfie, E. Martini, A. da Costa Lima, F. Silvestri, C. Menozzi, A. Reichensperger, F. Santschi, J. D. Hood, etc., with a bibliography of the current literature (economic and non-economic) of the neotropical fauna.

Annual subscription $4.00 U.S. ($5.00 U.S. through booksellers). All payments are in advance. The back volumes are still on sale; price of each volume 4 U.S. dollars; through booksellers 5 U.S. dollars.

Subscriptions should be sent to the Editor; Thomaz Borgmeier, O.F.M., Convento S. Antonio, Largo da Carioca, Rio de Janeiro, Brazil.

AS a result of trials carried out last season we have produced four types of D.D.T. insecticides which are being used this season on a small, commercial scale, both at home and abroad.

When supplies of D.D.T. are commercially available, these products (and others which are now in the experimental stage) will be marketed under the registered trade name of

DEDETANE

These new insecticides, like all other Murphy products, will only be offered for sale after considerable research and practical experience. Our recommendations will therefore be based on actual commercial use.

Please send for informative booklets.

THE MURPHY CHEMICAL CO. LTD., WHEATHAMPSTEAD, HERTS.

ENTOMOLOGICAL LITERATURE

LARGEST STOCK IN THE WORLD

of Books, Serials and Pamphlets, in all Languages, relating to INSECTS, SPIDERS, MITES and TICKS.

CATALOGUES ON APPLICATION

Liberal allowances in cash or exchange will be made for authors' reprints, and other works of entomological interest.

JOHN D. SHERMAN, JR.,

132 PRIMROSE AVENUE, MOUNT VERNON, NEW YORK

A CATALOGUE OF THE PARASITES AND PREDATORS OF INSECT PESTS

Prepared by the Imperial Parasite Service
under the direction of W. R. Thompson, D.Sc., F.R.S.

The first instalment of this work, covering the insects of the world and containing rearing records published between 1913 and 1937 inclusive, is now in course of preparation.

The following parts of the Parasite Host Catalogue (Section I), listing parasites under hosts, are now ready :—

Part 1. Parasites of the Arachnida and Coleoptera, listing about 1,300 parasites under about 1,000 hosts (pp. ix and 151).

Part 2. Parasites of the Dermaptera and Diptera, listing about 950 parasites under about 600 hosts (pp. v and 99).

Part 3. Parasites of the Hemiptera, listing about 1,500 parasites under about 1,000 hosts (pp. v and 149).

Part 4. Parasites of the Hymenoptera, Isopoda and Isoptera listing about 1,150 parasites under about 980 hosts (pp. v and 130).

Part 5. Parasites of the Lepidoptera (A-CH), listing about 1,580 parasites under about 640 hosts (pp. v and 1-130).

Multigraph, 8″ × 10″ (approx. Crown 4to), bound in cloth-covered boards.

The price of each part is $2.00 (Canadian) or 10*s*. sterling, obtainable from Imperial Agricultural Bureaux, *Central Sales Branch, Aberystwyth,* from Imperial Agricultural Bureaux, *2, Queen Anne's Gate Buildings, London, S.W.1,* for London booksellers, or from the Imperial Parasite Service, *228, Dundas Street, Belleville, Ontario, Canada.*

Geigy D.D.T.

StaffAllenS have pleasure in announcing that they have been appointed Sole Distributing and Selling Agents for D.D.T. Insecticide.
Present supplies are reserved for military requirements, but all enquiries as to post-war deliveries of D.D.T. and for information on its uses should be addressed to :—

STAFFORD ALLEN & SONS, LTD.
Insecticide Manufacturers.
WHARF ROAD, LONDON, N.I.

Issued in conjunction with the Manufacturers and Patent Holders—
THE GEIGY COLOUR CO., LTD., PARSONAGE, MANCHESTER, 3.

TAS/AL 182

Universidad de Puerto Rico. Estación Experimental Agrícola. Informe bienal años fiscales 1941–1942. [Biennial Report of the University of Puerto Rico Agricultural Experiment Station for the fiscal Years 1941 and 1942.]—105 [+15] pp., 12 figs. Rio Piedras, P.R. [1943.]

It is stated in the course of this report that about 35 per cent. of cotton plantings in Porto Rico were attacked by the pink bollworm [*Platyedra gossypiella*, Saund.] in 1941, large plantings suffering more severely than small ones. Larvae of *Alabama argillacea*, Hb., destroyed about 60 per cent. of the foliage in an experimental plot.

The Braconid parasite, *Mirax insularis*, Mues., which was introduced from Guadeloupe against *Leucoptera coffeella*, Guér., on coffee [*cf. R.A.E.*, A **30** 293], parasitised only 2·9 per cent. of the leaf-miners in September 1940, 10 of 1,400 examined in October 1941, 6 of 2,040 in February 1942 and 4 of 2,000 in April 1942. It is concluded that it does not thrive so well in Porto Rico [*cf.* **31** 23] as in Guadeloupe, where it parasitises 65–85 per cent. of *Leucoptera*.

Trichogramma minutum, Ril., was released experimentally against *Diatraea saccharalis*, F., on sugar-cane from 1936 to 1941. The results have not yet been fully assessed, but it is evident that no control is afforded by releasing the parasite in fields in which eggs of *Diatraea* are scarce and no additional control if one-third or more of the eggs are already parasitised. Conditions are seldom suitable for releases on the north coast, but are fairly favourable in winter on the south coast.

Larvae of a species of *Batrachedra*, probably *B. mathesoni*, Busck, which attacks the flowers of coconut in Florida, infested 25–30 per cent. of pineapples in two localities in Porto Rico. They feed at the bases of the fruits at flowering time, and as the fruits grow the perforations increase in size and exude gum. Infestation was reduced to 5 per cent. by spraying with a solution of 6 lb. soap in 100 U.S. gals. water or with 2 per cent. Diesel-oil emulsion, but these sprays caused some injury to the fruits. Two Chalcids, *Haltichella* sp. and *Brachymeria* sp., were bred from this Tineid, but they afforded little control.

It was observed in 1940 and 1941 that the fruits and particularly the flowers of pimentos [*Capsicum*] grown throughout the year for the local market were attacked by larvae of *Gnorimoschema gudmannella*, Wlsm. Pimentos grown for export, which ceases in March, are usually sown apart from other plantings and are much less attacked. If these plantings are not destroyed in March but continued for local consumption, infestation of the flowers increases, though few of the fruits are damaged, even in June. *G. gudmannella* also infests pimento in Mexico.

Persing (C. A.) [*i.e.* C. O.] & Brown (L. R.). **The present Status of Citrus Thrips Control.**—*Calif. Citrogr.* **29** no. 6 pp. 149, 160–161, 2 refs. Los Angeles, Calif., 1944.

The author indicates the areas in California in which the citrus thrips [*Scirtothrips citri*, Moult.] has developed resistance to tartar emetic [*cf. R.A.E.*, A **31** 411, etc.], and briefly describes the methods of using the spray of tartar emetic and sugar recommended for other districts. In recent investigations, various nicotine insecticides gave promising control of the thrips on lemon in resistant areas in southern California, and of these nicotine sulphate was the most economical and effective, but had little residual effect. This was corrected by adding sugar [*cf.* **31** 209], and extensive field experiments showed that nicotine sulphate was most effective with white granulated sugar, brown sugar or New Orleans molasses, and more effective with Black Strap molasses or blood albumin than it was alone. It is concluded that white granulated sugar is the most practical for use, the best spray consisting of 1 U.S. quart nicotine sulphate, and 4 lb. sugar per 100 U.S. gals. The types of equipment suitable for applying

(236) Wt. P6/3752 5/45 S.E.R. Ltd. Gp. 432 [A]

this spray are discussed. Treatments that were immediately followed by heavy dew were more effective than those followed by north winds and low humidity, but there was no apparent difference between application by day and by night. In the San Fernando Valley, good control was obtained with one application during the last week in May, followed by another during the first week in August, and other field tests have also shown that this spray should be applied early in the season before thrips become abundant and later before they again become numerous enough to injure new growth or small fruits. On oranges in the same valley, one application at petal-fall should prevent the scarring of the fruit and a second in late summer may be desirable to prevent leaf scarring on the autumn cycle of growth. The spray should not be used with alkaline materials, which liberate nicotine from it, or with zinc oxide, and oil sprays for the control of Coccids should not be applied for about two weeks before or after it. In districts in central California in which tartar emetic is no longer effective, sulphur dusts applied in March, when the overwintering eggs begin to hatch, at petal-fall and about two weeks later, or sprays of lime-sulphur with wettable sulphur applied at petal fall are the most effective proved materials for spring treatments on orange, and are usually also effective against citricola scale [*Coccus pseudomagnoliarum*, Kuw.]. There is not yet sufficient information on the use of the spray of nicotine sulphate and sugar on oranges in these districts for recommendations to be made, but it may be desirable where treatment against citricola scale is unnecessary or where oil sprays are used against Coccids and is the most promising treatment for late summer.

FARSTAD (C. W.). **Wheat Stem Sawfly in Flax.**—*Sci. Agric.* **24** no. 8 pp. 383–386, 2 figs. Ottawa, 1944.

The usual food-plants of *Cephus cinctus*, Nort., are wheat and wheat-like grasses, but, in the absence of these, it oviposits in other plants. Investigations in Saskatchewan and Alberta in 1942 and 1943 showed that it commonly attacks early sown flax on land that is already infested. The percentage infestation in fields sown in the first week of May varied from 67 to 80 in different localities, but no infestation was found in fields sown in the last week of the same month. The larvae apparently feed on the pith, which in some cases was completely separated from the xylem ; where this occurred, the larger larvae very occasionally entered small side branches, which were almost severed. There was no visible evidence of sterility in the ovules or shrinking of the seeds on infested plants. A tendency to bend and lodge was observed in 5–10 per cent. of the stems at the margins of some heavily infested fields, but this occurred only when the stems were also damaged by grasshoppers.

In some plants, the woody portion below the surface of the soil was partly mined.

The larvae grew more slowly and were less active in flax than in wheat, but some had reached the fifth instar by 12th August. The rate of mortality was not very high while the plants were green and succulent, but subsequently increased rapidly. Only dead larvae were found in flax fields examined throughout Saskatchewan and Alberta during and after harvest. It is concluded that *C. cinctus* is of little importance as a pest of flax, and that flax is of value as a means of ridding a field of it.

MCGOVRAN (E. R.). **Tests of new agricultural Crop Insecticides.**—*J. econ. Ent.* **37** no. 3 pp. 336–338, 16 refs. Menasha, Wis., 1944.

The author briefly reviews recent investigations in the United States on plant materials and synthetic organic compounds that have been proved to be toxic to insects injuring crops, and discusses their possible use as practical insecticides.

The organic compounds include parabromobenzenesulphonamide, 2, 4-dimethyl-3-pentanone semicarbazone and 4-methylcyclohexanone semicarbazone, but the toxicological data on these had not been published when this paper was written.

GOODHUE (L. D.). **Insecticidal Aerosols.**—*J. econ. Ent.* **37** no. 3 pp. 338–341. Menasha, Wis., 1944.

This paper contains a summary of the information on insecticidal aerosols given in earlier publications [*cf. R.A.E.*, A **31** 349, etc.], with the addition of recently collected data. For the liquefied-gas method, dichlordifluoromethane (Freon-12) is the most suitable propellent known, having a convenient pressure, a low heat of vaporisation and a low surface tension, and being non-toxic to man and the higher animals and non-inflammable ; it is a poor solvent for many insecticides, but a mutual solvent can be used. Methyl chloride is also a good propellent, but is toxic to man and weakly inflammable ; it is cheaper than Freon and a more general solvent for insecticides. Dimethyl ether and propane, which produce good aerosols, are too inflammable for general use but, like methyl chloride, can be used to dilute Freon up to the point of inflammability.

Methods of testing the aerosols are described. They may be used against greenhouse pests [*cf.* **33** 43–44], for which purpose Freon can be replaced by methyl chloride, and aerosols with a rapid settling rate have given very good results on outdoor garden plots and may possibly be effective for large-scale application to some field crops.

Research on the physical properties of aerosols has shown that the spraying properties of the solution are very important, since the efficiency of the aerosol depends on how it is formed. Liquid insecticides are best, but solids can be applied if they are dissolved in a good high-boiling solvent ; without it the solid may be deposited at the spraying orifice and block it. Moreover, liquid insecticides or solutions of solids do not coagulate so rapidly after being suspended in air, and they may have a more rapid physiological action on insects. The high-boiling solvent may increase the solubility of the insecticide in the liquefied gas, which is important, since aerosols are produced only from true solutions in the liquefied gas, not from colloidal suspensions. The particle size of the aerosol, measured by the settling rate, can easily be controlled by the amount of non-volatile material included ; when Freon is used, the optimum particle size appears to be that produced by 15 per cent. non-volatile material. It is pointed out that the saturated vapour above the liquid in the container has considerable weight and must be taken into account when the solutions are prepared and transferred from one container to another, and even during the dispensing of the solution if it is necessary to know the exact concentration. As the solution is discharged from the container, the concentration of what remains increases, so that when 90 per cent. is removed, the concentration of the remainder is 8 per cent. higher than that of the original solution. The lowering of vapour-pressure caused by a solute such as sesame oil in Freon is so slight that it is of no consequence in the practical use of the aerosol ; 15 per cent. oil reduces the pressure by only 36 mm. out of a total pressure of about 5,000 mm. The density of the solution is important in certain calculations, especially those involving the capacity of a container. The energy required to disperse the material varies with the surface tension and viscosity, but these characteristics have not yet been investigated.

HALLER (H. L.). **New agricultural Crop Insecticides.**—*J. econ. Ent.* **37** no. 3 pp. 342–344. Menasha, Wis., 1944.

The author discusses recent improvements in the preparation and application of insecticides containing nicotine and rotenone, and gives short notes on

investigations of new plant materials and synthetic organic compounds for insecticidal use in the United States.

HOWARD (N. F.). **Substitutes for Vegetable Insecticides.**—*J. econ. Ent.* **37** no. 3 pp. 345–346, 1 ref. Menasha, Wis., 1944.

This paper contains a list of the most likely substitutes for the insecticides formerly used on the commoner vegetable crops in the United States, and suggestions for improved methods of application by which important savings in materials could be made.

HANSBERRY (R.). **Substitute Insecticides for Fruit Crops and Ornamentals.**—*J. econ. Ent.* **37** no. 3 pp. 347–349. Menasha, Wis., 1944.

A review is given of the results that have been obtained with substitutes for the materials normally used against insects attacking apple and other fruits in different parts of the United States and also against those injuring ornamental plants and flue-cured tobacco.

SASSCER (E. R.). **Influence of the War on Plant Quarantine.**—*J. econ. Ent.* **37** no. 3 pp. 356–359. Menasha, Wis., 1944.

The author describes some of the difficulties caused by war conditions in the enforcement of plant quarantine regulations in the United States. A reduced personnel has had to deal with emergencies such as the evacuation of women and children from the Hawaiian Islands and the arrival of convoys without warning and (owing to enemy submarine activity) of ships containing restricted or prohibited material consigned to other countries. New problems have also resulted from the arrival of service mail from abroad, with no indication of origin, as illustrated by the discovery on several occasions of living larvae of the pink bollworm [*Platyedra gossypiella*, Saund.] in seed cotton used as packing material, and from the arrival of vessels with dry ballast consisting in part of topsoil, which it was proposed to dispose of on shore and which in some cases was found to be heavily infested with Elaterid and Curculionid larvae believed to be new to the United States.

SMITH (L. G.). **Insects affecting Vegetable Seed Crops in the western States.**—*J. econ. Ent.* **37** no. 3 pp. 362–370, 15 refs. Menasha, Wis., 1944.

An annotated list is given of 78 species of insects that attack seed crops of 18 kinds or groups of vegetables grown in the western United States, indicating the States in which they occur, the degree and type of damage caused and the control measures recommended, when these have been determined. The most important pest is *Bruchus pisorum*, L.; the maximum infestation reported in peas is 85·5 per cent. (in 1939), but suitably timed applications of rotenone dust usually keep the average infestation below 5 per cent. *Cydia* (*Laspeyresia*) *nigricana*, Steph., causes severe damage to peas grown in north-western Washington, and no control measures are known. The pea aphis, *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) is normally important only in the coastal areas of Oregon and Washington in dry seasons; during wet ones it seems to be controlled mainly by entomogenous fungi. *Sitona lineatus*, L., which has recently become established in Washington [*cf. R.A.E.*, A **31** 356], attacks peas, vetch and lucerne. *Brevicoryne brassicae*, L., and *Hylemyia brassicae*, Bch., seriously affect the production of cabbage seed, and *Ceuthorrhynchus assimilis*, Payk., for which no control measures are known, destroys about 25 per cent., of that produced each year in Washington.

SORENSON (C. J.). **Insect Problems of Field-crop Seed Production in the West.**—*J. econ. Ent.* **37** no. 3 pp. 371–376, 10 refs. Menasha, Wis., 1944.

Lucerne is the principal hay crop in the western United States, largely supporting the extensive livestock industry during winter and taking a major place in crop rotations, and the need for lucerne seed has greatly increased during the last 10–15 years because of loss of plantings owing to bacterial wilt disease and of the practice of shorter rotations. Since 1925, however, the yields of seed have declined rapidly in Utah and neighbouring States, and investigations during the last ten years indicate that a major part of this decline has been caused by insects. Capsids of the genus *Lygus* have been found to be the most injurious because of their universal distribution in lucerne fields, dense populations, wide range of food-plants, high reproductive potential and the difficulty of controlling them [*cf. R.A.E.*, A **27** 462 ; **29** 567 ; **31** 338]. In Utah, the species present are *L. elisus*, Van D., *L. hesperus*, Knight, and *L. oblineatus*, Say, in order of abundance ; the last is rare except in the south. *Adelphocoris superbus*, Uhl., occurred in injurious numbers in the first planting of lucerne in one district of Utah in 1931–33 ; individuals of this Capsid are more injurious than *Lygus*, but its food-plant range is narrower and its reproductive capacity much lower. All fields of lucerne and clover [*Trifolium*], are damaged by *Bruchophagus gibbus*, Boh., which reduces the seed crop considerably, but it is fairly satisfactorily controlled by uniform selection of the same lucerne growth for the production of the seed crop throughout an area, by burning all chaff and seed screenings or using them for fodder before late spring, by preventing self-sown lucerne from producing seed, and by renewing seed fields in late autumn or early spring. In years in which wild food-plants fail to furnish adequate food, large swarms of the Pentatomid, *Chlorochroa sayi*, Stål, migrate into cereals to feed on the young grains and from these to neighbouring second-growth lucerne ; such infestations result in partial or complete destruction of the seed crop if the stage of seed development is favourable for feeding, and no satisfactory method of preventing attack is known. Other insects attacking lucerne are grasshoppers, which devour leaves and full-grown green pods and seed ; *Hypera variabilis*, Hbst. (*postica*, Gylh.), which causes indirect damage to seed produced from the first growth by feeding on the buds and leaves, but may be controlled by dusting with calcium arsenate in sulphur ; and thrips, particularly *Frankliniella occidentalis*, Perg., the exact effect of which is not known.

Reports from the different States indicate that seed clover is seriously damaged by *Dasyneura leguminicola*, Lint., in Montana and occasionally by *Anuraphis* (*Aphis*) *bakeri*, Cowen, in Oregon ; that *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) and *Bruchus brachialis*, Fhs., are the principal pests of seed vetch in Oregon and Washington, but can be controlled by a dust containing 0·75 per cent. rotenone applied at the rate of 20–30 lb. per acre ; and that *Cydia* (*Laspeyresia*) *nigricana*, Steph., and *Sitona lineatus*, L., also cause severe damage to vetch in Washington [*cf.* **31** 356].

The pests of field maize in Utah include *Heliothis armigera*, Hb., and, in dry years, Aphids and Tetranychid mites. Those observed in Iowa in 1943 were *H. armigera*, *Diabrotica longicornis*, Say, *Pyrausta nubilalis*, Hb., wireworms, larvae of the genus *Lachnosterna* (*Phyllophaga*), *Anuraphis maidiradicis*, Forbes, and *Aphis maidis*, Fitch, but only *Diabrotica* caused much injury, and a good crop was obtained. Seed wheat, barley, oats and rye generally suffered slight damage from insects in the western States during 1943. The production of sugar-beet seed suffers from attacks by various insects ; the most important are *Eutettix tenellus*, Baker, which damages the crop by transmitting curly-top disease [*Chlorogenus eutetticola* of Holmes], *Lygus* spp. and *Chlorochroa sayi*, which reduce the percentage of viable seed produced [*cf.* **32** 216]. In Arizona, species of *Lygus*, *Creontiades femoralis*, Van D., and other bugs reduce the

production of seed cotton by 0–40 per cent., and seed crops of grain sorghum are often damaged by *Diatraea grandiosella*, Dyar, and *Elasmopalpus lignosellus*, Zell., and sometimes by Aphids and *H. armigera*.

LINSLEY (E. G.). **Protection of dried packaged Foodstuffs from Insect Damage.**—*J. econ. Ent.* **37** no. 3 pp. 377–379, 1 ref. Menasha, Wis., 1944.

The resistance of different types of packing materials to insect penetration is discussed [*cf. R.A.E.*, A **32** 266], and it is pointed out that even where infestation does not result, such penetration admits air and moisture, the exclusion of which is particularly important in the case of dehydrated products and certain dried fruits that are packed in a gaseous atmosphere to prevent some types of deterioration ; it may also result in contamination of the products or in the transport of insects to places where they may infest other materials. Moreover, dehydrated foods, in spite of their low moisture content, are subject to insect damage and require essentially the same protection as air- and sun-dried products.

The insect most commonly found in dehydrated vegetables in California is *Plodia interpunctella*, Hb., which infests carrots, beets, cabbage, broccoli and potatoes at moisture contents as low as 6 per cent. *Ephestia kuehniella*, Zell., attacks the same products but does not usually thrive in them. Under experimental conditions, *Tineola biselliella*, Humm., did not infest dehydrated vegetables ; *Sitodrepa* (*Stegobium*) *panicea*, L., *Lasioderma serricorne*, F., *Rhyzopertha dominica*, F., and *Tribolium confusum*, Duv., appeared to thrive in carrots but infested potatoes less successfully ; *Aphanotus destructor*, Uytt., *Gnathocerus cornutus*, F., *Anthrenus verbasci*, L., *Attagenus piceus*, Ol., *Dermestes maculatus*, Deg., *Tenebrio molitor*, L., *Calandra* (*Sitophilus*) *granaria*, L., *C.* (*S.*) *oryzae*, L., and *Ptinus fur*, L., were able to survive for some time on one or more of the vegetables, but did not reproduce satisfactorily ; and *Oryzaephilus surinamensis*, L., and *Tenebroides mauritanicus*, L., failed to feed appreciably on carrots or potatoes. None of these insects has been found in dehydrated vegetables.

Dehydrated fruits are subject to infestation by the same insects and mites as dried fruits, since the moisture content of the two commercial products is similar, but are easier to pack in an uninfested condition as the drying process kills any insects already in the fruits. On dehydrated fish (5 per cent. moisture content), half-grown larvae of *D. maculatus* and *Anthrenus verbasci* completed their development and subsequently oviposited, but the young larvae of the former died ; adults of *Tribolium confusum* and *Aphanotus destructor* fed for as long as two months, but larvae of various ages did not survive ; and adults of *Tineola biselliella* oviposited, but the larvae died in the first instar. The only insect so far encountered in dehydrated eggs, milk and other dairy products is *Trogoderma versicolor*, Creutz., but it is probable that other Dermestids or Ptinids and Tineids may occasionally be injurious.

COTTON (R. T.). **Protection of stored and dried processed Foods and Seed Supplies from Insect Attack.**—*J. econ. Ent.* **37** no. 3 pp. 380–384, 1 fig., 1 ref. Menasha, Wis., 1944.

In this paper, the author points out that if grain can be kept dry, cool and clean, it can be stored for years without appreciable deterioration from insect attack, and lists the most serious insect pests of stored grain and discusses their temperature and moisture requirements. He gives details of the best methods of storing maize and wheat to prevent infestation in different parts of the United States and of controlling infestation when it occurs, showing the dosages of common grain fumigants satisfactory for use in steel bins for both grains, and discusses methods, which must not injure germination, of protecting seed from attack and also of preserving dried processed foods from insect damage. The

last include fumigation, the use of high-speed sifters, centrifugal force machines and heat sterilisation, and the packing in insect-proof bags [*cf.* preceding abstract].

CARTWRIGHT (W. B.) & LAHUE (D. W.). **Testing Wheats in the Greenhouse for Hessian Fly Resistance.**—*J. econ. Ent.* **31** no. 3 pp. 385–387, 2 figs. Menasha, Wis., 1944.

Field-plot tests of the resistance of wheats to *Mayetiola* (*Phytophaga*) *destructor*, Say, in autumn are often inconclusive in Indiana, because of insufficient infestation, delays in the sowing or germination of the seed owing to adverse weather, and the effect of early frosts and low autumn temperatures in retarding the development of infestation and extending the examination of the nursery rows into the winter season, so that no significant results may be obtained for one or more years and wheat stocks become overburdened with lines susceptible to the fly. A method of testing wheat varieties for fly resistance under controlled conditions in the greenhouse was therefore developed in 1938–43. Flies were reared in the greenhouse on susceptible wheat, a continuous emergence of several hundreds per day from October to April being obtained. It was found that day temperatures of 65–70°F., night temperatures approaching 60° and a humidity above 40 per cent. were desirable. *M. destructor* bred prolifically in the greenhouse, with egg, larval and pupal periods of 3–5, 11–20 and 10–15 days, respectively, at day temperatures of 60–70°. The wheat seedlings to be tested, with control rows of susceptible and resistant varieties, were caged with 40 healthy females and 20 or more males per 300 plants when they reached the one-blade or two-blade stage, usually 5–8 days after sowing. The plants were uncovered when enough eggs had been deposited on them, and infestation counts were made during the third and fourth weeks after oviposition by digging each row of plants and recording the number and percentage carrying at least one healthy larva or viable puparium. The results were interpreted by comparing the infestations of the test wheats with those in the resistant and susceptible strains in the same group of plants, and showed enough correlation with data obtained in the field to be satisfactory for practical purposes. A similar test of the progeny of apparently resistant plants is advisable, to determine which, if any, are heterozygous and which are escaped susceptibles.

Sufficient data have not been obtained on the proper temperature and humidity requirements for storing infested wheat plants during the summer, but moderate success has been obtained by storage at 35–43°F.; puparia have remained viable when infested plants were stored dry in the greenhouse, where no special effort was made to maintain a high humidity, but where they were shaded as much as possible from the direct heat of the sun and protected from mice. To prevent parasites from breeding in the greenhouse and depleting the stocks of flies, parasitised stocks are isolated, and any flies emerging from them are separated from the adult parasites by means of an aspirator, after which the parasites are destroyed. After the eggs of the fly have hatched, Aphids on the plants are controlled with a dust containing not less than 4 per cent. nicotine, and mildew is controlled on stock wheats by using seed of a variety resistant to it or by dusting with fine sulphur.

GLASS (E. H.). **Recirculation in atmospheric Fumigation of Commodities with Nitriles.**—*J. econ. Ent.* **37** no. 3 pp. 388–391, 3 figs., 3 refs. Menasha, Wis., 1944.

It had previously been reported that the dosage of a mixture of ethylene oxide and carbon dioxide required to give complete mortality of adults of *Tribolium confusum*, Duv., in a vacuum chamber loaded with rice could be reduced by 25 per cent. if the gas was recirculated in the chamber by means of a vacuum pump and by-pass, apparently because this process caused the release of some of the

gas absorbed on the outer portion of the commodity so that it soon became more uniformly distributed throughout the chamber. Recirculation for 15 minutes of the one hour exposure produced the same increase in effectiveness as longer periods. Tests were therefore made to determine whether recirculation is also advantageous in atmospheric chambers. Adults of *T. confusum* were exposed or buried in 800 gm. white flour in a 6-litre container and fumigated with a mixture of acrylonitrile and carbon tetrachloride (5 : 5 by volume) or of trichloracetonitrile and acrylonitrile (7 : 3 by volume), which was or was not recirculated at the rate of one chamber volume per minute throughout the exposure period of one hour, by being pumped out of the bottom and returned at the top. Comparable dosage-mortality curves showed that recirculation did not increase the effectiveness of either fumigant, and similar results were obtained in a chamber of 740 cu. ft. capacity, fitted with ducts and a blower type fan that recirculated the gas at the rate of two or four chamber volumes per minute. In this experiment, two 98-lb. bags of flour containing adults of *T. confusum* in various positions were surrounded with 110 bags of sawdust, piled to fill 65 per cent. of the volume of the chamber, and the fumigation period was 12 hours, with or without recirculation for part or all of the exposure. The vapour of the second mixture was more toxic than that of the first and also appeared to penetrate deeper into the flour in lethal concentrations.

LANGE jr. (W. H.). **Insects affecting Guayule with special Reference to those associated with Nursery Plantings in California.**—*J. econ. Ent.* **37** no. 3 pp. 392–399, 3 figs., 4 refs. Menasha, Wis., 1944.

This paper contains information collected in the Salinas Valley of California in 1942 on the insects attacking guayule (*Parthenium argentatum*), a shrub that has recently received attention in the United States as a source of rubber. The same insects were present in the nurseries and the field plantings, but insect populations were greater in the nurseries. Although many species of insects are associated with guayule, infestations have not yet assumed major importance.

The more injurious of the numerous insects recorded include *Diabrotica undecimpunctata*, Mannh., which feeds first on the leaves and then on the developing flowers in the adult stage, particularly in the neighbourhood of bean fields, and was controlled with a dust containing 50 per cent. natural cryolite or 0·2 per cent. pyrethrins and 1·65 per cent. thiocyanate from Lethane 60, applied at 100 lb. per acre. Damage to the roots by *Limonius californicus*, Mannh., *L. canus*, Lec., and *L. infuscatus*, Motsch., was found in nurseries in May–August, but an emulsion containing 2·5 or 5 cc. dichlorethyl ether per U.S. pint water applied at 1–2 U.S. pints per plant or 1 U.S. pint per foot of row protected the plants without injuring them. *Empoasca arida*, DeLong, *Macrosteles divisus*, Uhl., *Draeculacephala minerva*, Ball, and *Carneocephala fulgida*, Nott., which were the commonest of the 14 species of leafhoppers found, all bred on guayule, but caused no serious injury ; rotenone extracts and combinations of rotenone and pyrethrum extracts reduced populations in the nurseries. *Frankliniella moultoni*, Hood, *F. occidentalis*, Perg., and *F. minuta*, Moult., were the commonest thrips, but caused no apparent injury ; *Thrips tabaci*, Lind., was also present in the flowers, but the extent of the damage it caused was not determined. A rotenone extract (5 per cent.) in water (1 : 800) with a spreader reduced the numbers of thrips, but pyrethrum extracts were ineffective. Larvae of *Estigmene acraea*, Dru., skeletonise the leaves of nursery plants ; they were controlled by spot treatment of the infestations with 3–4 lb. lead arsenate per 100 U.S. gals. water with a suitable spreader and by means of ditches dug round the beds to trap the migrating larvae in autumn. *Agromyza virens*, Lw., mined in the stems of nursery plants and injured them considerably, but did not usually kill them ; it appeared to produce two generations a year and was heavily parasitised by the Pteromalid, *Syntomopus americanus*, Ashm., and the Miscogasterid, *Halticoptera*

aenea, Wlk. Certain plots of transplanted guayule suffered severe injury from the adults and possibly the larvae of the Dynastid, *Ligyrus californicus*, Csy., which fed on the cortex of the roots, and one plot was practically defoliated by grasshoppers in July 1942. Capsids of the genus *Lygus* were the most abundant insects on guayule during the flowering period, and *L. sallei*, Stål, often caused severe wilting of terminal growth in spring. The Scolytid, *Pityophthorus nigricans*, Bldf., attacks the plants after they are dead or soon after they are cut and causes injury to stacks of guayule awaiting treatment for rubber extraction, apparently breeding in the same bark and wood for several years.

In tests to determine the effect of standard insecticides and fungicides on guayule plants in the nursery, plants treated with 50 per cent. sodium fluosilicate dust, 1 per cent. dinitro-o-cresol dust or a spray of 1·5 lb. 2, 4, dinitro-6-cyclohexylphenol per 100 U.S. gals. showed injury seven days after treatment, but all but those receiving the dinitro dust were recovering 23 days later. No injury was caused by sprays of lead arsenate, cryolite, tartar emetic, lime-sulphur, light medium oil emulsion or Bordeaux mixture, or by dusts of calcium arsenate, cryolite, sulphur or phenothiazine.

Flanders (S. E.). **Diapause in the parasitic Hymenoptera.**—*J. econ. Ent.* **37** no. 3 pp. 408–411, 20 refs. Menasha, Wis., 1944.

The capacity of insects for undergoing diapause is of particular importance in work on biological control. The establishment of an introduced parasite may be impossible if its development includes a diapause that is not synchronised with that of its host, unless synchronisation of development can be brought about by artificially prolonging, initiating or breaking the diapause. In order to facilitate future studies, the author reviews and correlates the various instances of arrested development known in the parasitic Hymenoptera. He points out that diapause may occur in any stage of insect development, but is usually limited to a particular stage in any one species, and that some species that apparently lack the capacity for diapause are probably rarely, if ever, exposed to stimuli that may initiate it. Mere exposure to an unfavourable environment may not furnish the stimuli needed to initiate the diapause required for the existence of the species, and insects may undergo diapause when the temperature and food are favourable for continuous development, but the occurrence of the phenomenon in any individual is apparently determined by the environmental conditions (either internal or external to its mother) to which it is exposed. Examples are given of diapause as an immediate response and as a delayed response, and of the two types of diapause that may be recognised, the first in which tissue-forming material is used slowly, the maximum rate being at low temperatures, and the second in which the utilisation of tissue-forming material is inhibited. In insect species generally, the diapause period may be shortened somewhat by contact with water or by shocks of various kinds, but in individuals in which the utilisation of tissue-forming material is inhibited by lack of available water, it may be easier to prevent the occurrence of diapause than to terminate it.

Brunson (M. H.) & Allen (H. W.). **Mass Liberation of Parasites for immediate Reduction of Oriental Fruit Moth Injury to ripe Peaches.**—*J. econ. Ent.* **37** no. 3 pp. 411–416, 4 refs. Menasha, Wis., 1944.

The following is substantially the authors' summary. Studies of the effect of mass liberations of parasites to control *Cydia* (*Grapholitha*) *molesta*, Busck, were made in nine groups of peach orchards in southern New Jersey in 1938–42. In each group, not less than three orchards received liberations and not less than two were included as controls. Releases were made in a total of 31 orchards and over an area of 360 acres. *Macrocentrus ancylivorus*, Rohw., was used in 1938–42 and *Agathis* (*Bassus*) *diversa*, Mues., in 1938 and 1939. The parasites

were liberated during the five years at the average rate of 3·3 females per tree or 330 per acre of orchard, the greater number during the occurrence of the second generation, although some were released against the first.

Over the five-year period, an average of 47 per cent. less fruit was injured per tree in the orchards that received liberations than in the others. Supplementary evidence substantiated the conclusion that the reduction in fruit injury was due to the parasites released. The average parasitism of second-generation larvae was higher, the species liberated comprised a larger proportion of the total parasites reared from them in orchards that received parasites than in the others, and the number of moths of the second generation that emerged per tree was smaller.

Siegler (E. H.), Schechter (M. S.) & Haller (H. L.). **Toxicity of Ricin, Ricinine, and related Compounds to Codling Moth Larvae.**—*J. econ. Ent.* **37** no. 3 pp. 416–418, 10 refs. Menasha, Wis., 1944.

The following is substantially the authors' summary. A study of the toxicity of ricin and ricinine, which occur in castor (*Ricinus communis*), and also of synthetic ricinine and eight closely related compounds, to larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., showed that only ricinine (1, 2-dihydro-4-methoxy-1-methyl-2-oxonicotinonitrile) and 1, 2-dihydro-1, 4, 6-trimethyl-2-oxonicotinonitrile were effective killing agents. The structural formulae of both these compounds show a methyl group attached to the heterocyclic nitrogen atom and no free hydroxyl group attached to the ring.

Knowlton (G. F.). **Collops Feeding.**—*J. econ. Ent.* **37** no. 3 p. 443. Menasha, Wis., 1944.

In late May and June 1943, *Collops hirtellus*, Lec., was observed feeding on *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) in lucerne fields in northern Utah, where it was sometimes abundant. Small numbers of *C. bipunctatus*, Say, and either *C. vittatus*, Say, or *C. necopinus*, Fall, and *Lygus* bugs and *Nabis alternatus*, Parshley, were also collected, and another species of *Collops*, near *similis*, Schaeffer, was attacking the Aphid in one field. Both *C. hirtellus* and *C. vittatus* or *C. necopinus* fed voraciously on the Aphids when confined with them in petri dishes, and also attacked *N. alternatus* and *Lygus* nymphs. The second also fed on *Orius tristicolor*, White, *C. hirtellus*, *C. bipunctatus* and, less frequently, its own species.

Knowlton (G. F.). **Boxelder Bug Observations.**—*J. econ. Ent.* **37** no. 3 p. 443. Menasha, Wis., 1944.

In November 1943, large numbers of *Leptocoris trivittatus*, Say, were found in northern Utah round bee-hives on a warm slope, where they had apparently sought shelter for the winter under the hives and in crevices. Some were feeding on dead honey-bees. Observations in this part of the State have indicated that many of the adult bugs move during the autumn for distances of ½–2 miles and sometimes more from box-elder trees [*Acer negundo*], and that many others find winter shelter near their food-plants.

Sweetman (H. L.) & Kulash (W. M.). **The Distribution of *Ctenolepisma urbana* Slabaugh and certain other Lepismatidae.**—*J. econ. Ent.* **37** no. 3 p. 444, 3 refs. Menasha, Wis., 1944.

Ctenolepisma urbana, Slabaugh, which has already been recorded from buildings in Illinois and California [*R.A.E.*, A **30** 434], has been collected in North Carolina on several occasions since 1922 and has also been found in

Missouri and Louisiana; it is probably widespread in the United States, at least in regions where long warm summers prevail. *Lepisma saccharina*, L., and *Thermobia domestica*, Pack., are well established in buildings throughout southern Canada and the United States wherever the physical environment is favourable, and *Ctenolepisma quadriseriata*, Pack., is plentiful in the eastern United States and has been recorded as far south as Tennessee, as far west as Missouri and northward into south-central Canada. In Massachusetts, *C. quadriseriata* and *L. saccharina* are much more injurious than *T. domestica*; in laboratory tests, *C. quadriseriata* did much more damage to paper and fabrics than either of the other species.

Flanders (S. E.). **The Introduction and Establishment of *Habrolepis rouxi* in California.**—*J. econ. Ent.* **37** no. 3 pp. 444–445, 4 refs. Menasha, Wis., 1944

In 1937–39, over 50,000 females of the Encyrtid, *Habrolepis rouxi*, Comp., which had been introduced from South Africa [*cf. R.A.E.*, A **25** 77; **31** 328], were reared and liberated in various parts of southern California on *Citrus* and other plants infested by *Aonidiella aurantii*, Mask., and in 1941–42, about 50,000 were liberated against the olive scale, *Parlatoria oleae*, Colv., at Fresno. Males were produced in the laboratory, but mating did not occur. Although the parasite reproduced for one or two generations at many points in the field, it appears to have become established only south of San Diego [*cf.* **32** 222] where about 1,000 females had been released against *A. aurantii* on rose and *Citrus* in 1937. Its original host in Africa may be *Selenaspidus* (*Aspidiotus*) *silvaticus*, Ldgr., which was observed to be heavily parasitised on *Trichilia emetica* in the Kruger National Park.

Siegler (E. H.) & Gertler (S. I.). **Toxicity Tests of certain N-substituted Benzamides against Codling Moth Larvae.**—*J. econ. Ent.* **37** no. 3 p. 445, 1 ref. Menasha, Wis., 1944.

In further tests of aryl N-substituted benzamides against larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., by the apple-plug method [*cf. R.A.E.*, A **32** 56], none of the 28 compounds used showed toxicity.

Secrest (H. C.). **Damage to Red Pine and Jack Pine in the Lake States by the Saratoga Spittle Bug.**—*J. econ. Ent.* **37** no. 3 pp. 447–448, 2 refs. Menasha, Wis., 1944.

Serious damage to natural and planted red pine and jack pine [*Pinus resinosa* and *P. banksiana*] has recently occurred over relatively large acreages in the Lake States (Michigan, Wisconsin and Minnesota) and involved the death of trees up to 15 ft. in height in some cases. It was apparently caused primarily by *Aphrophora saratogensis*, Fitch, which feeds on pine only in the adult stage, and not by *A. parallela*, Say, to which previous Cercopid injury to pine has been attributed [*cf. R.A.E.*, A **31** 149, etc.]. Preliminary examination of the undergrowth in stands in and near the Manistee National Forest, Michigan showed that sweet fern (*Comptonia peregrina*) was apparently the preferred food-plant of *A. saratogensis*. The eggs are deposited between late July and September in slits in the outer bark of this plant near ground level, or under loose bark scales, and hatch in May. The nymphal stage is spent in a mass of froth near the base of the stems, usually just above the root collar but beneath the surface of the litter; several nymphs frequently feed together. The adults begin to appear in late June or early July and are active until October. Field collections and rearing studies over three years in Michigan showed that *A. saratogensis* was much more abundant than *A. parallela* and that damage was

heaviest where there was an association of pine and sweet fern. This association occurs naturally where the soil is poor, but many acres of jack and red pine have been established on such soil in all three of the Lake States. In areas where the pine was mixed with hardwoods or where the stands had closed, making growth conditions unfavourable for sweet fern, there was a marked decrease of injury, even in close proximity to severely injured stands ; this has been corroborated by observations in Minnesota and Wisconsin.

The first evidence of injury is slight yellowing of the foliage in September, following feeding by the adults during the summer, when small pinholes, many sealed by droplets of coagulated resin, may be found in the bark and wood immediately beneath. Red foliage does not usually become apparent until growth starts in the following spring. The death of a branch or tree is caused by the removal of sap, resulting in desiccation and a great reduction in the amount of stored food available for the next season's early growth, followed by the infiltration of the wounds with resin and the formation of scar tissue, which coalesces when the infestation has been very severe, producing a girdling effect in the phloem and xylem cells. Control measures comprise discouraging sweet fern in and near the plantation areas, and encouraging sufficient of the better hardwoods to make a good mixture and help crowd out any undesirable undergrowth. Planting sites should be selected where protection will be available, and planting on poor soils should be postponed until some natural regeneration of hardwoods has occurred.

Heavy mortality of the nymphs in one area was apparently caused in May, 1942, by a sudden fall in temperature to a minimum of about 16–18°F. after a warm period. In 1943, 89 per cent. of a series of fifth-instar nymphs that were put in freezing chambers were killed at a temperature of 18°F., and the remainder at 16°F. ; the younger nymphs died when the temperature dropped to the low twenties.

Yothers (M. A.) & Carlson (F. W.). **Chemicals to destroy overwintering Codling Moth Larvae in the Soil at the Base of Apple Trees.**—*J. econ. Ent.* **37** no. 3 pp. 448–450, 3 refs. Menasha, Wis., 1944.

Preliminary experiments on the control of larvae of the codling moth [*Cydia pomonella*, L.] that overwinter, or even remain for over a year, in the soil at the base of heavily infested apple trees [*cf. R.A.E.*, A **29** 559] were carried out in Washington in 1940–43. The soil round trees 30–35 years old was cleared of brushwood and débris, and liquids were applied to it by means of a bucket pump ; dry materials were applied in a complete ring round the tree either on the soil surface or in a small trench 1-2 inches from the trunk, which was then covered with a few inches of soil firmly pressed down. The applications were made in May, before many moths had emerged, and final records of the numbers of empty protruding pupal cases and of living and dead larvae and pupae on or near the trunk beneath the soil were made 3–5 weeks later. The sprays consisted of insecticides in cotton seed oil or stove oil emulsified in water, and the emulsifier was monoethanolamine oleate, except in the mixtures containing dinitro-ortho-cresol, for which another emulsifier was used. The stove oil was a light mineral oil with a viscosity of 32 secs. Saybolt and an unsulphonated residue of 70 per cent. The best insecticide in the sprays was dichlorethyl ether ; it gave 100 per cent. mortality when used at 20 per cent. with 20 per cent. cottonseed oil and 95 per cent. or more at 5 per cent. with 10 per cent. of either oil. Ethylene dichloride gave poor kills at any concentration below 50 or 60 per cent. Paradichlorbenzene at 20 per cent. by weight with 20 per cent. cottonseed or stove oil gave high kills but was difficult to dissolve. Sprays of 1 per cent. nicotine sulphate, with 5 per cent. sodium carbonate and 20 per cent. stove oil, and of 2 per cent. pyrethrum extract (2·5 per cent. pyrethrins) with 20 per cent. stove oil both gave 59 per cent. kill ;

and sprays of 0·25, 0·5 and 1 per cent. 4,6-dinitro-ortho-cresol [numbered with OH as 1] and 10, 10 and 20 per cent. stove oil, respectively, gave 92, 91 and 86 per cent. [*cf.* **31** 112]. Cottonseed oil undiluted and at concentrations of 50, 20 and 10 per cent. gave 96, 71, 5·6 and 6·9 per cent. kill, but stove oil at 20 and 10 per cent. gave no control. Calcium cyanide dust (40–50 per cent. $Ca(CN)_2$) gave 98 per cent. kill at 4 oz. per tree and 89 and 82 per cent. at 3 and 2 oz., but was ineffective in smaller quantities, and paradichlorbenzene killed 96–100 per cent. at rates of 1 oz. per tree or more, but only 88 per cent. at 0·5 oz. None of the materials was found to injure the trees.

The practical value of any of these treatments is doubtful, since comparatively few of the overwintering larvae in most orchards are at the bases of the trees. When trees are scraped, most of the larvae that would be killed by them are destroyed, and they will also be killed if a dormant spray is applied to the trunk [*cf.* **31** 112 ; **32** 273]. However, in cases of severe infestation where the trees have been thoroughly scraped or where there is little rough bark, a greater proportion would be in the soil and débris near the base of the trees, and these could be destroyed by soil treatment.

CLANCY (D. W.). **Experimental Parasitization Studies with the Comstock Mealybug.**—*J. econ. Ent.* **37** no. 3 p. 450, 1 ref. Menasha, Wis., 1944.

In experiments to determine the ability of parasites of other mealybugs obtained from California to develop in *Pseudococcus comstocki*, Kuw., *Leptomastix dactylopii*, How., and *Leptomastidea abnormis*, Gir., bred from *P. citri*, Risso, readily attacked it, but the numbers of progeny obtained averaged less than 50 per cent. of the original parasite stock in both cases. Several small field releases of *L. abnormis* failed to result in its establishment in apple orchards in the eastern States infested with *P. comstocki*. When adults of *Anarhopus sydneyensis*, Timb., reared from *P. adonidum*, L., were introduced into cages containing all stages of *P. comstocki* on potato shoots, they showed little interest in the mealybugs and produced no progeny. Adults of a species of *Tetracnemus*, presumably *T. peregrinus*, Comp., and perhaps also *T. pretiosus*, Timb., and of *Chrysoplatycerus splendens*, How., also failed to reproduce, but very encouraging results were obtained with *Coccophagus gurneyi*, Comp., 36 adults put in a cage with immature nymphs of *P. comstocki* giving rise to 530 young. Subsequent breeding attempts were equally successful when a few individuals of *Clausenia purpurea*, Ishii, were included to provide for the hyperparasitic development of the males, and *Coccophagus gurneyi* appears to be well adapted to *P. comstocki* as a host, propagation being accomplished about as readily as with its normal host, *P. gahani*, Green. Several recoveries, including one male from a cocoon of *Clausenia purpurea*, were made after a single release of 174 adults in a Virginia apple orchard, but it is not yet known whether *Coccophagus gurneyi* can survive the severe eastern winters.

CLANCY (D. W.). **Hyperparasitization of *Clausenia purpurea* Ishii, an important Parasite of the Comstock Mealybug.**—*J. econ. Ent.* **37** no. 3 pp. 450–451. Menasha, Wis., 1944.

The Encyrtid parasite, *Clausenia purpurea*, Ishii, was apparently introduced into the United States with its host, *Pseudococcus comstocki*, Kuw., and occurs practically wherever the mealybug is found. It exerts considerable control in some areas, but its effectiveness in Virginia is greatly reduced by native hyperparasites. During 1941 and 1942, numerous collections were made in apple orchards of parasitised mealybugs containing mature larvae and pupae of *C. purpurea* from each of the three annual generations, chiefly in west-central and northern Virginia ; the hyperparasites reared were two apparently undescribed species of *Lygocerus*, which comprised 76·1 per cent. of the total, *Thysanus*

niger, Ashm., and *T. elongatus*, Gir., of which the former was the more abundant, *Pachyneuron altiscuta*, How., *Tetrastichus minutus*, How., and one individual of an undescribed species of *Hyperimerus*. *C. purpurea* and its parasites were most abundant each year in the third generation of the mealybug; an average hyperparasitism of 25·9 per cent. was obtained from parasitised mealybugs collected during autumn and winter as compared with 9·6 and 3·4 per cent. for the first and second generations of the host, but when overwintered parasitised mealybugs were collected in April, just before the emergence of *C. purpurea*, a much larger proportion gave rise to hyperparasites. In systematic collections from the same orchards during November–December 1941, January–February 1942, and 27th–29th April 1942, the rates of total hyperparasitism were 13·9, 13·4 and 88·5 per cent., respectively. The final increase was due entirely to *Lygocerus*, which normally emerges in spring about three weeks before *C. purpurea*, immediately attacks the remaining overwintered parasites and completes another generation in them. This largely explains the relative scarcity of *C. purpurea* during the first and second mealybug generations and the inability of the parasite to control *P. comstocki* in Virginia, although other factors may be involved.

Wolcott (G. N.) & Martorell (L. F.). **Introduced Lady Beetles on Mona Island.**—*J. econ. Ent.* **37** no. 3 pp. 451–452. Menasha, Wis., 1944.

Seedlings of *Casuarina* introduced into Mona Island from Porto Rico (of which Mona Island is politically a part) were infested with *Icerya purchasi*, Mask., which became a serious pest, but was almost completely controlled when the Coccinellid, *Rodolia cardinalis*, Muls., was introduced about 15 years ago. The Agromyzid, *Cryptochetum iceryae*, Will., introduced from California in 1939, was ineffective, and the entomogenous fungus, *Spicaria javanica*, which has given complete control of *I. purchasi* in humid *Citrus* groves in Porto Rico, is much less effective on *Casuarina* and in the dry atmosphere of Mona [*cf. R.A.E.*, A **22** 152]. The only other natural enemies observed on Mona are larvae of *Chrysopa*, and as control by *R. cardinalis* is only partial, the Island serves as a reserve of the Coccinellid for Porto Rico, where it gives such complete local control that it fails to survive.

Heavy infestations of *Pseudoparlatoria ostreata*, Ckll., on a local race of papaya (*Carica papaya*) and of *Aspidiotus destructor*, Sign., on coconut palms and a single tree of *Barringtonia asiatica* have been practically exterminated by the Coccinellid, *Chilocorus cacti*, L., which was originally introduced into Porto Rico from Cuba and Texas and has apparently migrated to Mona.

Donohoe (H. C.). **Fumigation of Elm Wood containing Adults of *Hylurgopinus rufipes* Eich.**—*J. econ. Ent.* **37** no. 3 p. 452. Menasha, Wis., 1944.

As *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., is one of the vectors in the United States of the fungus [*Ceratostomella ulmi*] that causes Dutch elm disease and there is evidence that this Scolytid overwinters in elm nursery stock, the possibility of fumigating such stock before it is transported out of the area of infection has been considered. Samples of live elm logs, approximately 15 inches long and 3–8 inches in diameter, infested with overwintered adults, were therefore fumigated with methyl bromide in the spring of 1943. An average of 76·9 per cent. of the beetles in the logs were dead before treatment, presumably from cold, and a maximum of 22·2 per cent. of those from untreated logs died during the 20 days for which beetles removed from their hibernacula after treatment were kept under observation. Fumigation with 2·5 lb. methyl bromide per 1,000 cu. ft. for 4 hours, with 3 lb. for 4·5 hours and with 3·5 lb. for 3–4·5 hours at temperatures of 42–55°F. all gave complete mortality, but 3 lb. for 3·5 hours gave only 96·95 per cent., the survivors being in one log

8·5 inches in diameter and with thick corky bark. This type of bark structure is usually found only on trees of larger size than those commonly marketed as nursery stock.

These preliminary results indicate that fumigation could be developed for freeing elm nursery stock from hibernating bark beetles. In tests with 20 dormant bare-rooted trees, fumigated with 2·5–3·5 lb. methyl bromide per 1,000 cu. ft. for 3·5–4·5 hours, all but one tree survived and all but one of the survivors appeared to grow normally during the next season.

Service and Regulatory Announcements, January-June, 1944.—*S.R.A.; B.E.P.Q.* nos. 158–159, pp. 1–30, 33–55. Washington, D.C., U.S. Dep. Agric., 1944.

Announcements relating to Quarantine no. 72 against the white-fringed beetle [species of the subgenus *Graphognathus* of *Pantomorus*] include Administrative Instructions (B.E.P.Q. 503 fifth revision) (pp. 17–21) specifying the treatments authorised against them. These include the treatment of vegetable produce infested with larvae only by fumigation with methyl bromide at atmospheric pressure in refrigerator cars or other gas-tight containers. The dosages are 10, 9, 8, 7, 6, 5 and 4 lb. per car or 4, 3·6, 3·2, 2·8, 2·4, 2 and 1·6 lb. per 1,000 cu. ft. at temperatures of 56, 62, 68, 74, 80, 86 and 92°F., respectively. The produce must be exposed for two hours, and the mixture of fumigant and air caused to circulate for at least 5 minutes. Revised schedules are authorised for the fumigation with methyl bromide of plants in six-inch pots or soil balls not exceeding five inches in diameter at atmospheric pressure [*cf. R.A.E.*, A **27** 274] or of plants in soil balls not more than 16 inches in least diameter under partial vacuum, the latter being effective against all species [*cf.* **31** 468]. The dosages for atmospheric pressure are 4·5, 4, 3·5, 3 and 2·5 lb. per 1,000 cu. ft. at 70, 75, 80, 85 and 90°F., respectively, the exposure period in each case being two hours. The dosages for a partial vacuum are further modified in Administrative Instructions (B.E.P.Q. 503 fifth revision supplement 1) (pp. 51–52), in which they are 5, 4·5, 4, 3·5, 3, 2·5, 2·25, 2·125 and 2 lb. per 1,000 cu. ft. at 40, 45, 50, 55, 60, 65, 70, 75 and 80°F., respectively, the fumigation period being 1½ hours. The other treatments authorised have already been noticed [**27** 591 ; **28** 490 ; **29** 568 ; **31** 23].

Announcements relating to Quarantine no. 52 against the pink bollworm, *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pp. 43–49) make some changes in the regulated area and extend it to include parts of south-western Louisiana, where infestations were observed in 1943.

Announcements relating to potato regulations in the United States (pp. 52–53) contain Amendment no. 6 to regulation no. 7 [*cf.* **32** 112] authorising the importation under specified conditions of potatoes from the State of Tamaulipas, Mexico.

Other information includes a revised supplement to plant-quarantine import restrictions already noticed from British India (p. 23).

Keifer (H. H.). **Eriophyid Studies XIII.**—*Bull. Dep. Agric. Calif.* **32** no. 3 pp. 212–222, 10 figs., 1 ref. Sacramento, Calif., 1943.

This part of a series [*cf. R.A.E.*, A **31** 208] contains descriptions of ten new species, one from Hawaii and nine from California, for two of which new genera are erected. The Hawaiian species is *Eriophyes litchii*, which is a pest of litchee (*Litchi chinensis*) and infests the lower surface of the leaves, often causing them to curl. The others include *Phyllocoptes paracornutus*, which attacks the leaves and terminal shoots of almond, *Phytoptus hedericola*, which infests the buds and petiole bases of ivy (*Hedera helix*), causing leaf deformation and stunting of growth, and *Acaphylla* (gen. n.) *steinwedeni*, which is found on the leaves of *Camellia* in both California and Alabama.

McKinney (K. B.). **The Cabbage Looper as a Pest of Lettuce in the Southwest.**—*Tech. Bull. U.S. Dep. Agric.* no. 846, 30 pp., 10 figs. Washington, D.C., 1944.

The following is partly taken from the author's summary of this account of investigations in 1933-38 on the biology and control of *Plusia* (*Autographa*) *brassicae*, Ril., on lettuce in the Salt River Valley of Arizona. During years of sufficient rainfall in southern and central Arizona, wild food-plants on which this Noctuid breeds in large numbers appear in the desert areas ; in 1935, after a winter of exceptionally heavy rainfall, adults were numerous on *Encelia farinosa* near the cultivated areas at the beginning of May and larvae on *Pectis papposa* growing 15–35 miles away from them in August. As the desert areas had been practically bare between these dates, and the perennial brush is not a food-plant, the adults apparently migrated long distances in search of plants suitable for food and oviposition. In September, the wild plants were drying and adults were similarly compelled to migrate to cultivated areas. Two crops of lettuce are grown yearly in the south-west of the United States ; the spring crop, which is sown in the second half of October and grown during the winter, when *P. brassicae* is least active, is marketed practically free of injury in March and early April, but the autumn crop, which is sown in September and marketed during December and early January, is subject to attack every year.

The eggs are deposited singly on either side of the leaves and may hatch in 3–10 days, and the larvae may feed for 10–50 days. The pupal stage may be as short as six days in summer, but may last all winter, and the cocoons are usually attached to the under side of the lower leaves. A single female may deposit 200 eggs. All stages are attacked by parasites or predators. The eggs are parasitised by *Trichogramma minutum*, Ril., which becomes prevalent during summer and autumn, and are destroyed to an appreciable extent by the feeding of large larvae of their own species in autumn, when there is overlapping of the generations. The predominant larval parasite is the Tachinid, *Voria ruralis*, Fall., which exerts considerable control during late summer and autumn ; the degree of parasitism has been as high as 65–100 per cent. in November and December and as low as 19·8 per cent. in April, and as many as eight larvae per host have been found. *Euplectrus comstocki*, How., *Microplitis brassicae*, Vier., *Rogas rufocoxalis*, Gahan, *Sagaritis websteri*, Vier., and *Litomastix* (*Copidosoma*) *truncatella*, Dalm., have also been reared from the larvae, but they do not usually become numerous enough to give appreciable control. The Carabid, *Calosoma peregrinator*, Guér., preys on the larvae, particularly the larger ones, and smaller larvae are attacked by spiders. The pupae are often destroyed, apparently by beetles, mice or birds, and a few adults are killed by birds and many by bats.

The combined effect of the natural enemies in summer and the practice of growing lettuce during the autumn allows the crops to be grown with a minimum of artificial control. A large part of the damage comes at or immediately after thinning, since larvae from the discarded plants migrate to the remaining ones. Attempts to remove the former from the field with the larvae infesting them were unsuccessful, owing to the habit of the larvae of dropping from the plants when disturbed. Field-plot tests showed that under the irrigated conditions of the south-west, a dust of cryolite in talc (1 : 2) applied at 10–20 lb. per acre or one of Paris green and lime (1 : 6) or of undiluted calcium arsenate at 10–15 lb. per acre gives satisfactory control of *P. brassicae* on plants that are so small that the foliage will drop or be removed before they are marketed. A study of plant-growth records showed that lettuce could safely be treated with poisonous insecticides to within 35–40 days of harvest, but when applications are needed within 4–5 weeks of harvest, dusts of ground derris diluted with talc or sulphur to contain 1 per cent. rotenone, or of equal parts of pyrethrum flowers and talc, applied at 15–20 lb. per acre, should be used. Usually there is no further damage

if the infestation that develops after thinning is controlled, and it is therefore preferable to apply the insecticides 3–5 days before thinning to avoid a concentrated attack on the plants left standing. There was no appreciable difference in effectiveness between applications of the various dusts in early morning or late evening.

Boyce (A. M.), Korsmeier (R. B.) & Dickinson (R. C.). **Control of Orange Worms.**—*Calif. Citrogr.* **29** no. 7 p. 179. Los Angeles, Calif., 1944.

Tortrix (*Argyrotaenia*) *citrana*, Fern., is the most important of four moths [*R.A.E.*, A **28** 123] of which the larvae attack orange fruits in California, and much of this paper deals with its control [*cf.* **31** 59]. The larvae of *Pyroderces rileyi*, Wlsm., which occurs in association with it in two counties, and also those of *Holcocera iceryaeella*, Ril., are principally scavengers, but they feed to some extent on the peel and pith of oranges and so cause injury similar to that due to *T. citrana*. *P. rileyi* did not complete its development on a diet consisting solely of orange fruit ; dead organic matter appears to be essential and dead flowers probably comprise the principal food. The flowers are webbed together on the fruit, and as many as twenty larvae have been observed in a single mass, though apparently only one or two attack the fruit in such cases. The larvae are rarely present after the dead flowers have been washed from the trees by the summer or autumn sprays or winter rains, but a population is maintained on dead, mummified fruit on the ground or on the trees. The results of preliminary tests of cryolite dusts and sprays against this Tineid were not promising.

Lindgren (D. L.), La Due (J. F.) & Dow (D.). **Preliminary Studies with DDT in Control of the California Red Scale.**—*Calif. Citrogr.* **29** no. 7 pp. 180–181, 1 fig. Los Angeles, Calif., 1944.

The results are given of laboratory and preliminary field tests of the value of 2,2-bis (parachlorphenyl)-1,1,1-trichlorethane (DDT) against *Aonidiella aurantii*, Mask., on *Citrus* in California, some of which have already been noticed [*R.A.E.*, A **32** 264, 375]. This insecticide was as effective against young crawlers 75 days after it had been applied to the fruit [*cf.* **32** 264] as at the beginning of the experiment. Sprays containing 1·5 per cent. kerosene or 0·33 per cent. of a light petroleum oil (viscosity 43–45 sec. Saybolt) to which DDT was added at the rate of 8 or 4 gm., respectively, per 100 ml. oil gave complete mortality of settled individuals of the first and second instars, but only 32 and 51 per cent. mortality, respectively, of mature females. The oil emulsions alone were relatively ineffective ; the petroleum oil killed 91–95 per cent. in the first and second instars, but only 18 per cent. of the mature adults. In order to obtain a higher percentage kill of adults, cubé was added to the oils containing DDT ; 1·7 gm. cubé and 4 gm. DDT per 100 ml. oil in an emulsion of 1 per cent. petroleum oil or 3 per cent. kerosene gave almost complete mortality in adults and complete mortality in crawlers. In laboratory tests, dusts containing DDT appeared to be effective in preventing the young crawlers from settling and developing.

Swain (R. B.). **Nature and Extent of Mormon Cricket Damage to Crop and Range Plants.**—*Tech. Bull. U.S. Dep. Agric.* no. 866, 44 pp., 13 figs., 11 refs. Washington, D.C. [1944.]

The following is based on the author's summary. Investigations of the nature and importance of the damage caused by *Anabrus simplex*, Hald., to cultivated and range plants were carried out in 1938 and 1939. Intensive studies were largely confined to Nevada, Idaho and Oregon, where the heaviest outbreaks were to be found, but the major infestations in adjacent States were

briefly surveyed; damage surveys covered all States in which control programmes were in operation. Detailed field studies were carried out in a series of permanent observation plots, one-tenth of an acre in extent, in areas where infestation was heaviest. The plots contained marked plants for which growth and injury records were kept. "Spot" observations and transects of ten point-observation plots, 100 sq. ft. in area, through a damaged portion of a single vegetation type, were used to sample range feeding elsewhere. Injury was measured in the permanent plots in terms of percentage losses in seasonal forage production and in dry weight of all herbage. The transects measured injury in terms of one or the other. A food-plant list was compiled so as to indicate broadly the preference of *A. simplex* for the various species.

A. simplex and *Peranabrus scabricollis*, Thos., are the only Decticine Tettigoniids at present of economic importance in the north-western part of the United States. The former occurs from the Red River Valley in north-western Minnesota southward through western Kansas and Colorado to the mountains of northern New Mexico and westward to the Sierra Nevada and Klamath Mountains of California and the Cascades of Washington and Oregon. In Canada, it occurs in the southern portions of the Provinces adjacent to its range in the United States. *P. scabricollis* is present in Washington, Oregon, Idaho, Montana and probably other western States, but was of economic importance only in one area in Oregon in 1939. The feeding habits of the two insects and the measures employed against them are identical. *A. cerciata*, Caudell, and *A. longipes*, Caudell, which have been collected only in the north-western quarter of the range of *A. simplex*, are potentially important pests, but were not injurious in 1939.

A. simplex is a general feeder on vegetation, but prefers cultivated plants to most range plants for food. The injury to plants is due to the removal of vegetative and reproductive parts, the breaking of the flower stalks by the weight of the feeding insects, or, rarely, the girdling of the twigs of shrubs. The nymphs of all instars injure plants in the same way as the adults, and, because of the range of instars present in an average band of nymphs at any one time, the moulting period does not appear to cause periodic cessations of feeding by the band as a whole. The insects were most frequently observed feeding at temperatures between 70 and 95°F.; they fed more heavily on sunny days than on cloudy ones and usually ceased at dusk, but sometimes continued well into the night if high daytime temperatures prevailed. They show a definite preference for the inflorescences of plants, so that moderate damage to a cereal crop on a percentage volume basis may result in the almost complete destruction of all grain, and small, scattered, annual range plants may be exterminated locally. The kind of grasshopper damage most frequently observed in parts of Wyoming and South Dakota during 1939 was strikingly different, in that leaves and leaf sheaths were stripped from the culms of cereals and range grasses whereas the inflorescences were not harmed. Of the 62,977 acres of crops damaged by *A. simplex* in 1939, at least two-thirds were infested with nymphs by the end of May. After the end of June, the areas newly infested diminished steadily, and in August, when most of the cereal crops were harvested, only 80 acres of cultivated crops were reported as newly invaded. Most damage to crops was caused by nymphs and adults before the time of oviposition.

A. simplex occurs in all the major types of vegetation found within the limits of its distribution. Plant composition and altitude do not noticeably affect its distribution, but the former does determine the relative importance of the damage to range land in different States. This is of great importance in the sparse herbage of the northern desert shrub areas in Oregon, Nevada, Idaho and Utah, where, because the dominant plants are shrubs relatively unattractive as food, injury to the principal forage grasses and weeds may be heavy. It is less important in the short grass (mixed prairie) vegetation of Montana, South Dakota, Wyoming and Nebraska, where the weight of herbage per unit area

is relatively so great that similar amounts of feeding cause a much lower percentage of injury, damage being too slight to be measured by the methods used in 1939. In these States, the destruction of seeds of perennial grasses could not be measured in terms of forage production or weight loss and is believed to have had practically no effect on the density and composition of the range in 1939. In Oregon, Idaho and Nevada, recurrent injury to plants such as snowberry (*Symphoricarpus* spp.) may be sufficient to cause their death; this was demonstrated by records of marked plants in permanent plots in Oregon and Nevada. Perceptible changes in plant density and composition that occurred in some of the permanent observation plots are believed to have been due to both *A. simplex* and drought, the relative importance of the two factors being impossible to determine.

Maximum seasonal forage loss due to feeding by *A. simplex* reached 100 per cent. in several localities in Nevada and Oregon; where this occurred, the insect was present throughout the season. One heavily damaged area lost 45 per cent. of its total weight of herbage during 1939. This amounted to 280 lb. (dry weight) per acre of forage and non-forage plants. The seasonal forage losses for the same area were 74 per cent. for cattle and 98 per cent. for sheep. Observations at the same sites for two years have shown that almost total destruction of seasonal forage may occur in successive years, but the areas in which this is likely to occur are, as a rule, small and limited in number.

WYLIE (W. D.). *Crambus haytiellus* (**Zincken**) **as a Pest of Carpet Grass.**—*Florida Ent.* **27** no. 1 pp. 5–9, 3 refs. Gainesville, Fla., 1944.

Crambus haytiellus, Zinck., which caused considerable injury to lawns of Bermuda and Japanese grass [*Cynodon dactylon* and *Zoysia japonica*] in Florida in 1921 [*R.A.E.*, A **10** 445], damaged an 80-acre pasture of carpet grass [*Axonopus compressus*] in the same State in 1943. The pasture was first inspected early in October, and the damage was observed as circular patches of dead grass on which the plants had been defoliated. Almost all of them were on small knolls, a few inches higher than the rest of the pasture. The damage resembled that due to white grubs, but the roots were intact. The larvae were numerous close to the edges of the patches of dead grass, and the latter increased rapidly in size and number during the ensuing month. Webbing by the larvae was conspicuous. The area over which the grass was killed increased from 33 per cent. of the pasture in early October to 90 per cent. in late November, when the observations were discontinued. Larvae, pupae and adults were present throughout this period, and there was no evidence of definite broods. Small patches of Bermuda grass in the pasture and an adjoining pasture of Bermuda grass were not injured, but carpet grass in the latter was completely destroyed. Natural enemies appeared to be of little importance; a few cocoons of *Eulimneria* (*Limneria*) *pattoni*, Ashm., were collected with larvae of *C. haytiellus* early in October, but none was seen later.

In the laboratory, eggs were deposited singly and unattached on the soil surface or on litter. Females given the choice laid rather more eggs in a pot containing carpet grass than in one containing St. Augustine grass [*Stenotaphrum secundatum*] and laid very few in a pot containing Bermuda grass. In a cage containing soil and two patches of carpet grass, one a few inches higher than the other, eggs were laid on the soil, generally close to the grass. Most were laid in a half of the cage that was kept wet, and there was no difference in the number laid at the two elevations. Of females kept in test tubes without food, about half oviposited; the number of eggs laid varied from three to 51 and averaged 30. When newly-hatched larvae were given a choice of Bermuda, carpet and St. Augustine grass, a large majority fed on the last, and the remainder on the other two grasses in approximately equal numbers; but field-collected larvae, mostly in the last three instars, all preferred Bermuda grass. The latter

test was repeated with the same result. The avoidance of Bermuda grass in the field is attributed to its erect habit, which affords less protection to the larvae than the low-growing carpet grass. Pupation takes place within a silken cocoon. The egg, larval and pupal periods occupied 5–7, 35–40 and approximately 14 days, respectively.

TAYLOR (D. J.). **Life History Studies of the Sugarcane Moth Borer,** *Diatraea saccharalis* **Linn.**—*Florida Ent.* **27** no. 1 pp. 10–13. Gainesville, Fla., 1944.

Work on the bionomics of *Diatraea saccharalis*, F., on sugar-cane in the Everglades district of Florida, was begun in February 1941, but had to be discontinued owing to the war. Four generations were reared in the laboratory between March and the end of the year, from eggs laid by moths that emerged from pupae collected in the field. The rearing technique is briefly described, and the average durations of the various stages and instars of each generation are shown in a table. The average time required for complete development varied from 78·2 days in July–September to 90·6 days in October–December. Oviposition records for five unmated and 11 mated females are summarised. For the mated females, the average preoviposition period and length of life were 2·3 and 4·4 days, and the average numbers of eggs laid and eggs found in the female at death were 221·7 and 119.

WATSON (J. R.). **A new Cuban Pest of Citrus,** *Cryptocephalus marginicollis* **Suffr. (Col.)**—*Florida Ent.* **27** no. 1 pp. 13, 18. Gainesville, Fla., 1944.

Four adults of *Cryptocephalus marginicollis*, Suffr., were received from an orange grower in Cuba who stated that the beetles feed in great numbers on recently-set oranges, causing as much as 25 per cent. to fall. The fruits from very early (January) flowers may escape injury, which is especially severe on those developing from late flowers. The beetles are active in the late evening, especially after rain, and at night; they do not attack the leaves. C. F. W. Muesebeck states that this Cryptocephalid appears to be very common in Cuba and has also been found in the Bahamas. It has been collected from a number of plants, but has not hitherto been reported as injurious to oranges. The larvae of related species appear to feed on dead vegetable matter on the surface of the soil.

FREAR (D. E. H.). **Deposition and Retention of Sprays. III. Apparatus and Methods for Laboratory Spraying.**—*Bull. Pa. agric. Exp. Sta.* no. 463, [1]+ 18 pp., 11 figs., 14 refs. State College, Pa., 1944.

The following is substantially the author's abstract. A laboratory method for the study of the deposition and retention of insecticide and fungicide sprays is described; synthetic surfaces attached to a rotating turntable are sprayed with an atomiser-type sprayer, to which is attached an overhead reservoir containing the spray suspension. The effects of time, pressure, concentration of toxicant and type of sprayer were investigated in connection with the performance of the apparatus, and the method finally evolved was found to give accurate and reproducible results. The sprayed plates can readily be subjected to artificial weathering tests, and retention coefficients calculated [*cf. R.A.E.*, A **29** 371, etc.]. Typical results are given.

DE SANTIS (L.). **Nota sobre calcidoideos argentinos, parásitos de insectos que viven en frutales.** [A Note on Argentine Chalcidoid Parasites of Insects that infest Fruit Trees.]—*Dagi* **1** no. 5 pp. 5–8, 3 figs. La Plata, 1942. **Algunos insectos útiles que convendría introducir en la República Argentina.** [Some useful Insects that might be introduced into the Argentine Republic.] —*Anu. rur. Prov. B. Aires* **10** pp. 239–249, 3 figs., 27 refs. 1942. Repr. in *Dagi* **1** no. 5, pp. 9–20, 3 figs., 27 refs.

It is recorded in the first of these papers that *Aphidencyrtus aphidivorus*, Mayr, was bred in December 1937, for the first time in Argentina, from *Anuraphis schwartzi*, Börn., on peach in the Province of Santa Fe. The Aphids were being attacked by the Syrphid, *Allograpta exotica*, Wied., from which several examples of the Pteromalid, *Pachyneuron syrphiphagum*, Brèth., were reared. *P. syrphiphagum* was also bred in La Plata, together with the Ichneumonid, *Diplazon laetatorius*, F., from pupae of *A. exotica* on rose in January 1938; in this case it was probably acting as a secondary parasite. The adults are briefly described. *Trichogramma koehleri*, Blanch., was found in La Plata parasitising eggs, probably of *Laphygma frugiperda*, S. & A., on a peach twig.

In the second paper, the author reviews work that has been done in Argentina on the biological control of insect pests, including the introduction of parasites and predators from other countries, and discusses several other natural enemies of Argentine pests in various parts of the world that he considers suitable for introduction.

Wein-, Obst- und Gartenbau. [The Cultivation of Grape-vines, Fruits and ornamental Plants.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **4** pp. 2277–2490. Weimar, 1939. [Recd. 1944.]

The papers in this section [*cf.* also *R.A.E.*, A **27** 297; **28** 271] include:— **Die San-José-Schildlaus in Oesterreich (Einblicke und Ausblicke fürs Altreich)** [The San-José Scale (*Quadraspidiotus perniciosus*, Comst.) in Austria (A Survey and Prospects for Germany)], pp. 2324–2334, by L. FULMEK [*cf.* **30** 249]; **Pests affecting Strawberries in Great Britain,** pp. 2341–2352, 5 refs., by W. E. H. HODSON [*cf.* **26** 383]; **Zur Lebensweise und Bekämpfung des Birnknospenstechers** (*Anthonomus cinctus* **Kollar**) [The Biology and Control of the Pear Blossom Weevil (*A. piri*, Koll.) (in Germany)], pp. 2353–2357, 1 pl., by [O.] JANCKE [*cf.* **26** 761]; **Some Observations on the Biology and the Development of the Codling Moth** *Carpocapsa* [*Cydia*] *pomonella* **L.** [on apple in Poland], pp. 2369–2375, by *S.* MINKIEWICZ [*cf.* **27** 163, etc.]; **The Biology and Control of the Strawberry Leafroller,** pp. 2376–2387, by R. L. PARKER & P. G. LAMERSON, which deals with work on *Ancylis comptana*, Froel. (*fragariae*, Walsh & Ril.) in Kansas in 1934–38 [*cf.* **25** 774; **27** 374, 376] and includes a list of 40 species of parasites reared from it; **Ein Beitrag zur Biologie der Apfelsägewespe** *Hoplocampa testudinea* **Klug in Polen** [Contribution to the Biology of the Apple Sawfly, *H. testudinea*, in Poland], pp. 2436–2438, 2 pls., by K. STĘPNIEWSKA [*cf.* **27** 675]; **Oekologie und Bekämpfung der Erdbeermilbe** *Tarsonemus fragariae* **H. Zimmermann** [Ecology and Control of the Strawberry Mite, *T. pallidus*, Banks (in Switzerland)], pp. 2472–2490, 2 pls., 2 graphs, 11 refs., by R. WIESMANN [*cf.* **30** 88]; and **Neue Winterspritzmittel zur Bekämpfung der grünen Schilcherwanze in Steiermark** [New Winter Sprays for Combating *Lygus spinolae* in Styria], pp. 2335–2340, in which L. FULMEK gives an account of tests of winter sprays against *Lygus spinolae*, Meyer, on vines [**27** 45], and states that two of these sprays, the tar distillate of the Baumspritzmittel type at concentrations of 7 and 8 per cent. and a preparation containing dinitrocresol at 1½ per cent., also proved to be satisfactory ovicides against the apple sucker (*Psylla mali*, Schm.).

In **Parasitäre Spezialisation und pflanzliche Immunität nach Untersuchungen über die Reblaus** [Parasitic Specialisation and Immunity of Plants based on

Investigations on *Phylloxera*], pp. 2279–2290, 3 figs., 3 refs., C. Börner points out that all organisms of which the genetics have been studied for many generations demonstrate a profusion of hereditary changes that may or may not be favourable to them. In the case of parasites, each physiological change leads to higher specialisation and host restriction. To afford evidence of the way in which races and species of parasites are evolved, the author discusses some of the results of the extensive observations carried out by himself and Schilder [*cf.* **2** 156 ; **9** 609 ; **17** 582 ; **23** 156] on the resistance of different vines to *Phylloxera* (*Dactylosphaera*) *vastatrix*, Planch., and to the variety (*vitifoliae*, Fitch) of this Aphid that he considers a distinct species. He concludes that differences in resistance have resulted from complex interrelations between hereditary variations in the plant and in the insect. Analysis of the heredity of grape-vines indicates the occurrence of countless independent Mendelian factors of resistance to *Phylloxera* ; but it is also shown that Mendelian factors in the Aphid result in its ability or failure to survive on a given kind of vine, the neutralisation of the gall-forming substances in the saliva depending on weakness factors in the Aphid as opposed to resistance factors in the vine. It follows, therefore, that the extremely complicated reaction system of the *Phylloxera* biotypes is to be explained by the constant association and mutual interrelation of the various immunity and resistance factors in the vines with definite weakness factors in *Phylloxera*.

In **Contributo alla conoscenza dei parassiti temporanei della mosca delle olive** (*Dacus oleae* **Gmel.**) [A Contribution to the Knowledge of the seasonal Parasites of the Olive Fly (*D. oleae*)], pp. 2291–2295, 2 refs., G. Bua gives the results of observations made near Salerno on the biology of parasites of *Dacus oleae*, Gmel., and the relations between them and plants other than the olive. Of the parasites obtained from *Dacus* on olive in 1931–35 *Eupelmus urozonus*, Dalm., was the most abundant, followed by *Eurytoma rosae*, Nees ; *Eulophus longulus*, Zett., was much less numerous and *Dinarmus dacicida*, Masi, was rare [*cf.* **25** 69]. The percentages of *Dacus* parasitised at the outset of infestation (August) were over 92·5 in 1931 and 1932, and only 56·2, 69·4 and 24·8 in 1933, 1934 and 1935, and the damage to the olive crop appeared to be inversely proportional to the degree of parasitism at this time. Factors that affect the latter include the size of the initial *Dacus* population, climatic conditions, and the presence or absence of wild or cultivated plants that may be food-plants of insects that are alternative hosts of the parasites of *D. oleae*. The parasites were obtained from *Dacus* in large numbers in August and part of September, in moderate numbers in October, and rarely in November, but little or nothing is known of their biology after they leave the olives and the *Dacus* larvae. During 1933–36, plants or parts of plants of 11 species, a list of which is given, were collected in different localities at different times of the year and kept in rearing cages. The parasites of *Dacus* that emerged were *Eupelmus urozonus* and *Eurytoma rosae* ; both were found in cages containing *Calycotome spinosa* in July 1933 and July 1934, and the former in cages containing *Cistus monspeliensis* and *Inula viscosa* in August and October 1933, respectively. Their hosts on these plants were not ascertained. In the course of the experiments, *Polychrosis botrana*, Schiff., which feeds on the flowers and fruits of grape-vines and, in spring, on the flowers of olive, was obtained from *Daphne gnidium* and *Myrtus communis*.

In **Insect Pests of the Genus** *Rhododendron*, pp. 2296–2323, 6 maps, 1 plate, 113 refs., G. Fox-Wilson briefly discusses the distribution of plants of the genus *Rhododendron* in relation to the spread of insects that attack them and the effect of climate and ecological factors on the latter, and gives notes on the feeding habits and distribution of the chief pests of hardy rhododendrons that occur in Britain [*cf.* **27** 295]. A list is appended of the insects and mites that are pests of rhododendrons in various parts of the world, showing the countries in which they have been recorded, with references to the papers from

which the records were taken, and, in some cases, species of the host plant, the country of occurrence and the reference to the species of *Rhododendron* attacked.

In **Die Biologie von** *Carpocapsa pomonella* **L. als Grundlage ihrer Bekämpfung** [The Biology of *Cydia pomonella* as a Basis for its Control], pp. 2358–2364, by K. Küthe, the author emphasises the fact that successful control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in Germany depends on a knowledge of whether one or two generations a year are produced in the locality concerned [*cf.* **25** 527]. The number of generations may differ with altitude in localities only 3–6 miles apart and should be ascertained by examination of larvae in trap bands in late July and early August. Spraying dates for places where one or two generations occur are suggested; lead arsenate has proved the best insecticide. It is also desirable to ascertain whether a calyx spray is necessary [*cf.* **27** 163]; this depends on the local climate and the variety of apple.

In *Taeniocampa gracilis* **F. als Gartenschädling in Estland** [*T. gracilis* as a Pest of Gardens in Estonia], pp. 2365–2368, 4 refs., K. Leius gives an account of damage to apple nursery stock by the larvae of *Taeniocampa gracilis*, F. Damage was first reported in 1923, and had become very extensive by 1926. The adults were reared in 1936 and 1937; they emerged during the last ten days of April and oviposited in the second week of May, laying their eggs close to the buds. In 1937, the larvae hatched between 24th and 27th May, completed their development in 27–31 days and pupated just below the surface of the soil. The pupae hibernated. In orchards, eggs were laid only on apple and raspberry and the larvae hatched when the apples were in leaf and the flower-buds were about to burst. They wandered to the tips of the shoots and webbed themselves singly among the very young leaves. They fed on the parenchyma and also attacked the shoots, stopping their growth. Each larva damaged several shoots, and the young grafting stock in nurseries was thus dwarfed and deformed so that its value was greatly reduced. Crushing the larvae in the leaves at weekly intervals proved the most effective control measure, but satisfactory results were also obtained with dusts of pyrethrum or pyrethrum and rotenone. Arsenical sprays did not penetrate inside the webbed leaves.

In **Der Einfluss des Futters auf die Entwicklung des Goldafters** *Nygmia phaeorrhoea* **L. und des Ringelspinners** *Malacosoma neustria* **L.** [The Effect of Food on the Development of *N. phaeorrhoea* and *M. neustria*], pp. 2388–2395, P. Petkoff (Petkov) gives an account of laboratory experiments in Bulgaria, in which larvae of *Nygmia phaeorrhoea*, Don., collected on plum and oak were reared on oak leaves, and larvae of *Malacosoma neustria*, L., collected on oak were reared on leaves of the same species of oak, on beech leaves or on a mixed diet of leaves of various trees, including several species of oak. From the rate of development and eventual size of the larvae, it appeared that the change of diet was unfavourable for *Nygmia* and the mixed diet the most favourable for *Malacosoma*; the latter developed most slowly on beech leaves. The author concludes that polyphagous larvae prefer, and develop most rapidly on, leaves rich in tannin.

In **Neuere Feststellungen über die Biologie des Kleinen Frostspanners** *Cheimatobia brumata* **L.** [Recent Findings on the Biology of the Lesser Winter Moth, *Operophtera brumata*], pp. 2419–2435, 2 figs., 10 refs., W. Speyer, in addition to giving information already noticed on the bionomics and races of *Operophtera* (*Cheimatobia*) *brumata*, L., in Germany [**26** 420, 716; **27** 99], states that newly emerged females contain an average of about 300 mature eggs, and a number of immature ones of which only a few usually developed. The larvae preferred damp to dry sand for pupation, and experiments at atmospheric humidities ranging from 0 to 100 per cent. showed that normal pupation is impossible at relative humidities lower than 50 per cent. Many of the larvae and pupae in the laboratory were killed by *Isaria farinosa* and another fungus. A list is given of the insect parasites reared from larvae and pupae taken in the field;

Monochaeta albicans, Fall., was sometimes abundant enough to be of practical importance. The adults of this Tachinid emerged on various dates in April, their appearance being correlated with that of the larvae of the different races of *O. brumata*. The eggs are deposited on leaves and are swallowed by larvae of the host, and the larvae pupate in the host pupae.

Acker- und Gemüsebau [Agriculture and Cultivation of Vegetables.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **4** pp. 2491–2639. Weimar, 1939. [Recd. 1944.]

Two of the papers in this section have already been noticed [*R.A.E.*, A **28** 498 ; **29** 316], and four, one by M. Boczkowska and three by C. Blattný contain information already noticed from other sources [**27** 105, 469, 470]. In **Une larve apode méconnue vide, par périodes, les nodosités des légumineuses,** pp. 2493–2496, 1 ref., N. A. Barbieri describes the morphology of larvae found by him in large numbers in 1935 and 1936 in the nodules on the roots of beans in three districts in Italy. They hollowed out the nodules and then disappeared ; no larvae, pupae or adults were found after 60 days when an infested bean plant was planted in a pot enclosed in wire gauze. Similar larvae could not be found in 1937, but a very few were taken in 1938. The author suggests that they may have been larvae of *Muscina stabulans*, Fall., that had hatched from eggs deposited in manure before it was introduced into the bean fields. The loss of nodules caused no apparent harm to the plants.

In **A propos de la lutte contre les mouches de la chicorée de Bruxelles** *Napomyza lateralis* **Fall. et** *Ophiomyia pinguis* **Fall., Agromyzidae. Effet sur les larves mineuses du trempage des feuilles dans l'eau chaude,** pp. 2512–2521, 5 graphs, 1 ref., W. E. van den Bruel, refers to previous work which indicated that migration of the larvae of *Phytomyza* (*Napomyza*) *lateralis*, Fall., and *Agromyza* (*Ophiomyia*) *pinguis*, Fall., from the roots of forced chicory [**28** 539] to the leaves could be prevented by immersing the plants in water at 40°C. [104°F.] for 1½ hours, though the larvae were not all killed. He then describes experiments conducted with larvae in leaves to ascertain whether those paralysed by this treatment can eventually recover and he concludes that recovery does not occur. Pupae were more resistant, some yielding adults after immersion for 2½ hours at 39°C. [102·2°F.] or for 1 hour at 40 or 41°C. [105·8°F.]. In one instance, the parasite, *Dacnusa leptogaster*, Hal., emerged from a pupa that had been immersed for 3 hours at 40°C. No pupae survived, however, when they were immersed for 1 hour at 42°C. [107·6°F.], or for 1½ or 2 hours at 41°C.

In **La langosta voladora** *Schistocerca paranensis* **Burm. en la República Argentina,** pp. 2522–2528, 1 map, J. D. [*i.e.* J. B.] Daguerre summarises observations on *Schistocerca paranensis*, Burm., in Argentina during 1933–36 [*cf.* **28** 215]. It appears probable that the average female lays a total of over 400 eggs in nature, as females oviposited five times or more at progressively decreasing intervals under experimental conditions, and the average numbers of eggs in the successive egg pods were 80, 63, 73, 62 and 65. The first egg pod was laid in the second half of September, and the next four after intervals of 30–42, 17–23, 8–12 and 6–10 days.

In *Phthorimaea ocellatella* **Boyd. Die Rübenmotte, ein wichtiger Schädling in Nordspanien** [The Beet Moth, an important Pest in northern Spain], pp. 2529–2532, O. Günther describes the serious damage caused to sugar-beet in the region of the upper Ebro by the larvae of *Gnorimoschema* (*Phthorimaea*) *ocellatella*, Boyd. They are as abundant in fields that are irrigated as in those that are not, but are much less injurious in the former, as the inner leaves escape infestation owing to the luxuriant and rapid growth of the outer ones. In the non-irrigated zone, the outer leaves wither during the period of extreme heat and drought that commonly lasts from July to the end of September,

and the short inner ones alone secure the preservation of the necessary reserve of water ; the larvae then destroy the inner leaves, the plants eventually retain only 4–8 of the outer ones and the weight and sugar content of the roots are greatly reduced. The spring and summer in 1938 were very dry, and the infestation began in May and spread from field to field as the drought continued. The successive generations apparently overlapped, and the larvae occurred throughout the season, some boring in the stalks of the larger leaves and some feeding among the inner ones. Pupation probably takes place in the root [*cf.* **24** 15]. Partial control of the larvae and pupae is effected by allowing sheep to feed on the leaves discarded when the roots are harvested, and by ploughing the newly harvested fields and sowing winter cereals in them.

In **Zur Biologie des Luzernekäfers** *Phytodecta fornicata* **Brügg.** [Contribution to the Biology of the Lucerne Beetle], pp. 2533–2543, 2 pls., 7 figs., 1 graph, 1 fldg. table, W. Knechtel & C. Hrisafi give an account of field and laboratory observations in 1938 on the bionomics of the Chrysomelid, *Phytodecta fornicata*, Brüggemann, on lucerne in Rumania [*cf.* **11** 201 ; **26** 760]. All stages, including the four larval instars, are described in detail. The occurrence of only one generation a year in Rumania was confirmed. The emergence of the overwintered beetles from the soil depends on the weather ; they were numerous on the tips of lucerne shoots in March, when the average temperature was 7·2°C. [44·96°F.], though many were still in shaded places in the soil. Some of these beetles were taken to the laboratory where they oviposited from 24th March to 3rd June ; . the first oviposition took place at an average temperature of 19·8°C. [67·64°F.]. In the field, the first oviposition was observed on 18th April at a mean of 8·9°C. [48·02°F.]. The eggs were deposited on the lower leaves of the lucerne, though the adults occurred during the day chiefly on the tips of the shoots. The total number of eggs laid by individual females kept under the same conditions ranged from 61 to over 1,000 ; most females continued to oviposit until they died. The egg and larval stages lasted 6–9 and 14–22 days at an average temperature of 20·65°C. [69·17°F.], the latter period including a prepupal stage of 2–6 days. Pupation occurred in the soil at a depth of two inches and adults emerged after 5–9 days at 20·65°C. During the hot weather the young beetles re-entered the soil after a short period of feeding and came to the surface only occasionally and for short periods before hibernation.

In **The Turnip Root Fly** (*Phorbia floralis* **Fallen) in northern Scotland,** pp. 2576–2584, 10 refs., G. D. Morison describes the life-history of *Hylemyia* (*Phorbia*) *floralis*, Fall., which has become a serious pest of turnips and swedes in the northern third of Scotland since 1934 and also infests cabbage, cauliflower and kale. All varieties of turnips and swedes are attacked and on all types of soil, though the heaviest infestations are usually on sandy soils and the harder varieties appear to be better able to resist the injury. The fly has only one generation a year ; the adults emerge from early June to late August and are most numerous in the first week of August. Oviposition begins about a week after emergence ; the eggs are laid on the soil close to the plant and chiefly on the shaded and damper side. Mortality among the eggs and young larvae is high before the plants are firmly rooted in the soil and the leaves afford shelter [*cf.* **17** 142]. The larvae, which are present from the end of June to the end of October and are most numerous in early September, tunnel in the flesh of the turnips or swedes for several weeks and then pupate in the soil close to them. Most pupae are found at a depth of four inches, but some are twice as deep if the turnips or swedes are large and deeply buried [*cf.* **16** 414]. The pupal stage usually lasts 8–10 months, but some pupae remain in diapause for up to 20 months. The damage caused is not evident while the plants are growing, but half of the weight of the crop may be lost, its keeping quality is greatly reduced, and sheep and cattle refuse to eat badly attacked turnips. Possible measures of control are discussed, but no method satisfactory on a field scale is known. Natural enemies observed by the author included rodents and sparrows that

destroyed the pupae, wireworms of the genus *Agriotes* which fed on them in light sandy soils, and an unidentified Proctotrupid that emerged from the pupae in June–August.

The Combating of Pests of other Insects by the Introduction of the Formicidae. The Use of this Method in the Past, and the Possibilities of such a Method for future Use, pp. 2585–2601, 23 refs., by B. D. W. Morley, contains lists of families, genera or species of ants that are predacious on termites and on other insects, followed by notes on their habits. The difficulties of breeding colonies to int oduce them against insect pests is pointed out, and suggestions are made regarding the methods of transporting ants and the factors to be considered in deciding whether a species is suitable for introduction into a particular country against a particular pest. The encouragement of indigenous species is recommended, and *Solenopsis geminata*, F., which destroys the cotton boll weevil [*Anthonomus grandis*, Boh.] in Texas, and *Formica rufa*, L., which destroys forest pests in Germany, are cited as examples. In conclusion, an annotated list is given of ten species of ants that might be used against various pests, showing the countries in which they occur and into which they might be introduced and the kinds of insects they attack.

In **Die Bekämpfung der Heuschrecken mit** *Empusa* [The Control of Locusts with *Empusa*], pp. 2616–2618, P. Petkov states that *Empusa grylli* has caused high mortality of *Calliptamus* (*Caloptenus*) *italicus*, L., during outbreaks of the latter in Bulgaria. Experiments showed that it spreads rapidly in examples of this locust kept in groups, and that healthy ones become infested if given food contaminated with the brown pulpy matter found in the hind part of the abdomen of locusts killed by it [*cf.* **27** 427]. Conditions favourable for its development were temperatures of 19–27°C. [66·2–80·6°F.] and a moderate atmospheric humidity ; mass development in the field occurred only in summer. In field experiments in August at a temperature of 18·7–27·3°C. [about 66–81°F.] and a relative humidity of 41–81 per cent., spores of the fungus scattered on plants killed 83 per cent. of the locusts in six days.

Die Schädlinge des Oelmohnes in Ungarn [Pests of Poppy cultivated for Oil in Hungary], pp. 2625–2639, 6 refs., by G. von Szelényi, contains notes on the bionomics and economic importance of ten species of insects that attack cultivated poppy [*Papaver somniferum*] in Hungary. The most injurious are the weevils, *Ceuthorrhynchus macula-alba*, Hbst., *C. denticulatus*, Schr., and *Stenocarus fuliginosus*, Marsh., and the Cecidomyiid, *Dasyneura papaveris*, Winn., and these and the Cynipid, *Timaspis papaveris*, Kieff., are specific pests of poppy. The other species, which are polyphagous, comprise *Otiorrhynchus ligustici*, L., *Agriotes sputator*, L., *Mamestra* (*Barathra*) *brassicae*, L., *Adelphocoris lineolatus*, Goeze, and *Aphis* (*Doralis*) *fabae*, Scop. Much of the information on *C. macula-alba*, which is the most injurious of all the pests and against which no effective measure has been found is similar to that already noticed [*cf.* **24** 402]. *Dasyneura papaveris* is often associated with it as a secondary pest ; the fly deposits its eggs in batches of 10–40 on the inner side of the edge of the hole made in the capsule by the weevil a few hours previously. The larvae damage the seeds and contaminate them with saliva, and the infestation is almost invariably followed by the appearance of mould. The larvae pupate in cocoons in the capsules. The usual food-plant of this Cecidomyiid is the common red poppy (*Papaver rhoeas*) which is infested by *C. albovittatus*, Germ., but only rarely by *C. macula-alba*.

The two root weevils, *S. fuliginosus* and *C. denticulatus*, differ little in bionomics [*cf.* **24** 703 ; **31** 52], but *S. fuliginosus* is much the more abundant. Since 1879, it has occurred in outbreak numbers in Hungary at regular intervals of 11 years, and this periodicity suggests that poppy fields might be safeguarded in outbreak years by dusting with a contact insecticide to kill the adults in spring, though the prevalence of rainy weather would make it necessary to apply a concentration that would be effective in a few hours.

Falconer (D. S.). **On the Behaviour of Wireworms of the Genus *Agriotes* Esch. (Coleoptera, Elateridae) in Relation to Temperature.**—*J. exp. Biol.* **21** no. 1–2 pp. 17–32, 13 figs., 24 refs. London, 1945.

The following is substantially the author's summary. The highest temperature that the wireworms could withstand for an indefinite period without becoming paralysed was between 35 and 36°C. [95–96·8°F.] Resistance to high temperature was not influenced by the previous temperature. Resistance to low temperature was greatly influenced by the rate at which the temperature was reduced. When the temperature fell rapidly, all wireworms were killed by exposure for six days to −3°C. [26·6°F.] or for four hours to −7°C. [19·4°F.]. Resistance to low temperature was not increased by a previous exposure of 24 hours at 0°C. [32°F.], when the subsequent fall of temperature was rapid. When the temperature was lowered in small stages, however, resistance was considerably increased, and a few wireworms survived for at least a day at −10°C. [14°F.]. Published data suggest that soil temperatures above 30°C. [86°F.] or below about −1°C. [30·2°F.] are not of regular occurrence in England, and it is concluded that wireworms in England are not normally liable to encounter lethal temperatures.

The relation between the wireworm's speed of crawling and the temperature was nearly linear between 8 and 25°C. [46·4–77°F.]. Burrowing activity was uniformly greater at higher than at lower temperatures between 6 and 33°C. [42·8–91·4°F.]. Temperature influenced the speed but not the continuity of the activity. After adaptation had taken place, the burrowing activity was almost nil at 6°C. When the wireworms were subjected to a sudden fall of temperature from 16°C. [60·8°F.] to 6°C., their burrowing activity was significantly greater in the first two hours than it was at the same temperature 16 hours later. The weight of wheat eaten by wireworms was greatest at 32°C. [89·6°F.], but feeding activity was most continuous at about 18°C. [64·4°F.]. At 7 or 34°C. [44·6 or 93·2°F.], little feeding took place.

No vertical movements in response to gravity were exhibited by the wireworms under any conditions of temperature. When given a choice in an alternative-chamber apparatus, they showed a clear preference for 17°C. [62·6°F.] as against 11·5°C. [52·7°F.] and 21°C. [69·8°F.] or higher temperatures. The temperature preference was not influenced to any great extent by the previous temperature. The mechanism by which the wireworms reacted at a temperature boundary was of the nature of a " shock reaction," their direction of movements being reversed. No evidence of klinokinetic response to change of temperature was obtained from wireworms burrowing in sand.

Falconer (D. S.). **On the Movement of Wireworms of the Genus *Agriotes* Esch. (Coleoptera, Elateridae) on the Surface of the Soil and their Sensitivity to Light.**—*J. exp. Biol.* **21** no. 1–2 pp. 33–38, 4 figs., 6 refs. London, 1945.

The following is the author's summary. Wireworms, when kept in moist sand without food, moved about at random in the sand, and this movement sometimes brought them to the surface. When this happened, their responses to light and to lack of contact did not prevent them from emerging on to the surface and crawling about there for a considerable period of time. On the other hand, their response to the humidity of the air prevented their emergence into air of 85 per cent. (and probably higher) relative humidity. Though the emergence was conditional upon lack of food, the movement of the wireworms on the surface is hardly to be regarded as of a " food-seeking " nature, for they appeared to have no direct means of locating their food: the point of re-entry was determined principally by the ease with which the animals could burrow beneath the surface.

Wireworms were found to be extremely sensitive to light of all wavelengths including the red, the threshold intensity to which they responded being below that required for their observation.

MEIER (K.). **Bericht der Eidgenössischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für das Jahr 1940.** [Report of the Swiss Federal Experiment Institute for Fruit, Vine and Garden Cultivation at Wädenswil for 1940.]—*Landw. Jb. Schweiz* **57** pt. 5 pp. 419–461. Berne, 1943.

In **Die Obstbaumspinnmilbe,** *Paratetranychus pilosus*, **ihre Lebensweise und Bekämpfung** [The Fruit-tree Mite, *P. pilosus*, its Life-history and Control], pp. 425–426, R. Wiesmann states that apple and plum trees were very heavily infested by *Paratetranychus pilosus*, C. & F., in Switzerland in the summer of 1940. This mite usually has five generations a year in Switzerland ; the winter eggs are laid from the end of August until October and hatch in the following May. Development from the egg to the sexually mature female lasts 8–10 days at 24°C. [75·2°F.], 13–15 days at 18°C. [64·4°F.] and 26–33 days at 15°C. [59°F.], but no development occurs at 10°C. [50°F.]. Infestation is severe in July and August if the weather has been dry and warm in May.

Experiments on control showed that tar distillates (fruit-tree carbolineums) kill not more than 60–65 per cent. of the winter eggs, but a proprietary emulsion of petroleum oil gave almost complete mortality at a concentration of 5 per cent., though it was unsatisfactory at 3 per cent. Treatment at 5 per cent. would be expensive. For control of the mites in summer, 2 per cent. lime-sulphur, with a wetting agent, was superior to oil emulsions or a spray of nicotine and soap and would not be expensive. It should be applied in August, before the first winter eggs are laid, and will then largely replace winter treatment. A pre-blossom spray of lime-sulphur in the spring, which is useful against fungous diseases, will prevent an outbreak later in the year.

In **Bekämpfung der Obstbaumspinnmilbe** (*Paratetranychus pilosus*) **mit Oelemulsionen** [Control of the Fruit-tree Mite (*P. pilosus*) with Oil Emulsions], pp. 426–427, R. Menzel reports that 95–100 per cent. mortality of the winter eggs of *P. pilosus* was given in the laboratory by a proprietary emulsion of petroleum oil at 3 per cent. Observations on 7th May 1940 showed that apple trees that had been sprayed on 29th March with 3 per cent. of this emulsion or 5 per cent. of another one were almost free from infestation, while leaves bearing ten or more mites were found on the untreated controls. The sprayed trees were still practically free from mites on 4th July, whereas the others showed numerous summer eggs and typical discoloration of the foliage. These treatments are therefore effective, but in years in which abnormal heat does not favour the mites, the usual schedule of a tar distillate in winter and lime-sulphur before and after blossoming is sufficient.

In **Versuche zur Bekämpfung der Reblaus** [Experiments on the Control of the Vine *Phylloxera*], pp. 437–438, Menzel describes experiments carried out in view of the introduction into north-western Switzerland (Basle) of the so-called southern race of *Phylloxera vitifoliae*, Fitch, which unlike the northern race (*vastatrix*, Planch.) infests both roots and leaves of American vines grown for grafting stock [*cf. R.A.E.*, A **28** 327]. *Phylloxera* material from Basle caused numerous nodosities on the roots of various American vines in pots, whereas *Phylloxera* material from Zurich and the Ticino did not.

FAES (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1941 et 1942.**—*Landw. Jb. Schweiz* **57** pt. 5 pp. 462–498. Berne, 1943.

This report contains a section (pp. 473–476) on pests and diseases of fruit trees in Switzerland. During the last 20 years, *Quadraspidiotus* (*Aspidiotus*)

perniciosus, Comst., has become established on fruit trees in Europe in the basin of the middle Danube, the Caucasus, Portugal and Spain. In France, it was observed in 1935 on peach and pear in the Seigne valley (Alpes maritimes), in 1940 on apple in Vaucluse, and in 1941 in nurseries near Lyons. It was found in Italy in 1940 and 1941, and fumigation of all nursery stock with hydrocyanic acid gas was made compulsory in the northern and central parts of the country [*R.A.E.*, A **31** 180]. There is a danger that the scale may be introduced into Switzerland, or may already be there, especially if stock has been imported from Lyons.

The increased cultivation of fruit trees in Valais has resulted in the multiplication of several hitherto uncommon insects. Destruction of the buds is due largely to *Chloroclystis rectangulata*, L., and the apple blossom Tineid, *Argyresthia cornella*, F., while *Psylla costalis*, Flor, has become numerous on apple [*cf.* **27** 232] in several localities. *Anthonomus piri*, Boy., is increasing on pear in central Valais, where it destroys almost all the flower buds in some orchards. A spray of pyrethrum and soap gave good results, and Gesarol was very effective against the adults in the laboratory.

It is also stated (p. 477) that measures against *Leptinotarsa* (*Doryphora*) *decemlineata*, Say, on potato were continued in both years.

URQUIJO [LANDALUZE] (P.) & DADIN (J. M.). **Ensayo de los parásitos útiles *Trichogramma minutum* y *pretiosa* en la lucha biológica contra la *Cydia pomonella*.** [An Experiment with the useful Parasites, *T. minutum* and *T. pretiosum* for the Biological Control of *C. pomonella*.]—*Publ. Estac. Fitopat. agríc. La Coruña* no. 23 pp. 7–19, 6 figs. Corunna, 1943.

Breeding of *Trichogramma minutum*, Ril., and *T. pretiosum*, Ril., in eggs of *Sitotroga cerealella*, Ol., was continued [*cf. R.A.E.*, A **31** 121] throughout 1942 in north-western Spain, some two millions of each species being reared. Mites invaded some of the cultures, particularly from August onwards, and fumigation with carbon bisulphide was ineffective against them.

Experiments on the dispersion of these parasites and the value of liberating them against *Cydia pomonella*, L., in apple orchards were carried out in three localities, and the results are shown in numerous tables. Cards bearing parasitised eggs of *S. cerealella* were suspended in containers, covered with wire gauze to exclude ants, in selected trees at various dates from the end of March to the end of June, and cards of unparasitised eggs were suspended in similar containers with the object of estimating the efficacy of the releases. It was impossible to draw any conclusions from these eggs, however, as hardly any became parasitised, probably because the gauze covers impeded the access of the parasites. In the orchard in which *T. minutum* was released, very few apples containing larvae of *C. pomonella* were found on trees up to about 27 yards from the point of liberation, infestation thereafter becoming greater, though it was still less than that observed in previous years. In that in which *T. pretiosum* was used, the harvest was poor, so that the results were inconclusive, but the percentage infestation was much less than the average for the district, which is about 70. In the third orchard, in which both parasites were released, infestation was much reduced on the actual trees on which the releases were made, but differed little on the others from that recorded in previous years.

Cards bearing eggs of *S. cerealella* parasitised by *Trichogramma* were also distributed to growers. The results obtained were fairly favourable in most cases and tended to show that releases were most effective during the first half of May, when oviposition by the overwintered generation was apparently at its peak.

Chorley (J. K.). **Report(s) of the Acting Chief Entomologist** [Southern Rhodesia] **for the Year(s) 1942** [and] **1943**.—16 pp., 17 pp., typescript. [Salisbury, S. Rhod., 1943–44.]

Insect pests in Southern Rhodesia in 1942 and 1943 are discussed as in previous reports [*R.A.E.*, A **31** 86, etc.]. In 1942, there was no general invasion by *Nomadacris septemfasciata*, Serv., and no oviposition by adults that completed their development during the year, but a few swarms flew into the Colony from the north in November and December. Flying swarms were reported in several districts in January and February 1943, and the first egg deposits on 19th January. Hopper outbreaks in March–May were small and scattered, except in two districts, and were the lightest since the beginning of the invasion in 1932 [**21** 672]. Flying swarms were present in and after the winter but no oviposition by them was reported. Larvae of *Laphygma exempta*, Wlk., seriously injured early-sown barley in two districts in 1942 and caused local damage to pasture in April 1943. In mid-December 1942, larvae of *L. exigua*, Hb., destroyed maize sown a fortnight earlier over an area of 300 acres and reduced the stand in other fields, but disappeared before the end of the month ; they had attacked seedling lucerne in another district in the preceding June, when they were parasitised by *Sturmia* spp. A small Lygaeid seriously damaged native crops of *Eleusine coracana* in two districts in January and February 1943. A local outbreak of the Dynastid, *Heteronychus licas*, Klug, on maize in January was controlled by hand collection. Damage to early-sown sunn-hemp (*Crotalaria juncea*) by *Exora discoidalis*, Jac., and, to a lesser extent, by *E. apicipennis*, Jac., has increased in areas where this crop has been grown for several years ; the exclusive use of other green manure plants for three years might so reduce the numbers of these Galerucids that *Crotalaria* could be grown without injury for a further period.

The incidence on tobacco of *Bemisia rhodesiaensis*, Corb., and the leaf-curl [*Ruga tabaci* of Holmes] that it transmits decreased during the two years under review ; this is attributed to the enforced cleaning of tobacco lands, including early disposal of unwanted seedlings and destruction of crop remains [**31** 360]. *Myzus persicae*, Sulz., was less abundant on tobacco in 1942 than in the previous years ; it damaged turnips in one district and was also recorded from potato, tomato and the weed, *Nicandra physaloides*. *Antestia lineaticollis*, Stål, practically disappeared from coffee at Umtali in 1943 ; its eggs are stated to have been heavily parasitised by a Braconid.

Attack by *Heliothis armigera*, Hb., on *Citrus* was light in both years ; *Scirtothrips aurantii*, Faure, was injurious at the end of 1943. Custard apple [*Annona squamosa*] was heavily infested by *Ceroplastes toddaliae*, Hall, in Salisbury early in 1942, and *Ceratitis* (*Pterandrus*) *rosa*, Karsch, was bred from mango fruit in the same district in February. *Aspidiotus combreti zizyphi*, Hall, was recorded for the first time on stems of papaya, and in December adults of the Tenebrionid, *Curimosphena fasciculosa*, Gebien, attacked the fruit of apple and peach in a district where it infested apple in 1930. *Helopeltis sanguineus*, Popp., appeared to be increasing in importance on tropical fruits such as guava and avocado, but was less injurious in 1943. *Parasa vivida*, Wlk., defoliated plum trees in March 1943. In preliminary experiments in the same year, light applications of arsenical bait-sprays controlled the Tingid, *Teleonemia australis*, Dist., on olive, but damaged the foliage.

Other pests recorded in 1943 included *Hellula undalis*, F., which mined the stems of cabbage plants ; and the Tortricid, *Epichorista ionephela*, Meyr., which damaged carnations in a commercial garden in July. A weevil, thought to be *Cylas formicarius*, F., which had not previously been recorded in the Colony, destroyed sweet potato plants grown in Salisbury from runners imported from Natal. It is hoped to eradicate it as it was not found on other plants 200 yards away and has only weak powers of flight.

No unusual outbreaks of pests of stored products occurred in 1942. In 1943, *Ephestia elutella*, Hb., could not be found in stored tobacco in a factory in which it had been numerous a few years before. Its control had been obtained by the application, 1–3 times a week according to the season, of a spray of white oil containing 0·8 per cent. pyrethrins, atomised at high pressure at the rate of about 1 fl. oz. per 1,000 cu. ft. unoccupied air-space. This treatment had not controlled *Lasioderma serricorne*, F., which had become more numerous in the factory since the war, probably owing to a decrease in the proportion of bales of maturing tobacco wrapped in paper. Fumigation with hydrocyanic acid gas (20 oz. sodium cyanide per 1,000 cu. ft.) for 89 hours, killed both exposed and slightly protected eggs. Fumigation with methyl bromide effectively protected stored seed wheat from severe damage by *Calandra oryzae*, L. *Tribolium confusum*, Duv., was found infesting a parcel of tobacco seed three years old.

A consignment of apples that had been fumigated with methyl bromide against *Cydia pomonella*, L., in Cape Colony and transported to Salisbury was examined by R. G. Nel in May 1943, after it had been kept in cold storage for over a month, and was found to be in satisfactory condition.

VRYDAGH (J. M.). **Etude comparée sur la biologie de** *Dysdercus nigrofasciatus* **Stål, et** *Dysdercus melanoderes* **Karsch.**—*Publ. Inst. nat. Etude agron. Congo belge* Sér. sci. no. 31, 32 pp., 3 col. pls., 1 graph, 22 refs. [Yangambi] 1942. Price Fr. 40. [Recd. 1945.]

The species of *Dysdercus* found on cotton at Bambesa in the Belgian Congo include *D. superstitiosus*, F., *D. nigrofasciatus*, Stål, and *D. melanoderes*, Karsch [*R.A.E.*, A **31** 297]. Some workers have suggested that the last two are merely forms of *D. superstitiosus* [**12** 68, 548], but the author rejects this view, as he found that they would not interbreed with it. They are more closely related to one another, but it appears from the investigations described in this paper that they are best regarded as distinct species that have become differentiated biologically and in coloration by segregation, though they can still produce fertile hybrids and interbreed in nature where their range overlaps. No reliable distinguishing character was found in the genitalia. *D. nigrofasciatus* is widely distributed throughout tree savannah in Africa, whereas *D. melanoderes* appears to be confined to humid equatorial forest. At Bambesa, on the northern limit of the forest, *D. nigrofasciatus* is present throughout the year, but *D. melanoderes* disappears in the third week of December, at the beginning of the dry season.

In hybridisation experiments, the fertility of the F_1 generation was only moderate, there was a tendency to inherit the characters of the female parent, the sex-ratio was unbalanced, and some individuals showed exceptional longevity. The F_2 generation comprised a continuous series of intermediate types that sometimes gave rise to new aberrant types when crossed. Fecundity became normal in the F_3 generation.

In the course of rearing *D. nigrofasciatus* from material collected in the field, the author obtained a stable, partly melanistic mutant, which he calls *nigrescens* or *D. nigrescens*, sp. n.; its coloration and size are compared with those of *D. nigrofasciatus* and *D. melanoderes* in a table. A continuous series of forms intermediate between it and *D. nigrofasciatus* was bred. Forms described from Kilimanjaro by Schouteden as varieties of *D. nigrofasciatus* are placed between *D. nigrofasciatus* and *D. nigrescens*, and a form of *D. melanoderes* described by Distant is placed between *D. melanoderes* and *D. nigrofasciatus*.

The bionomics of *D. nigrofasciatus* were studied in 1937 and those of *D. melanoderes* in 1940; the technique was that employed in similar investigations with *D. superstitiosus* [**31** 297]. The results for *D. nigrofasciatus* are in general agreement with those obtained by other workers in Uganda [**26** 372] and South

Africa [**19** 232; **27** 491]. The pre-mating period was shorter, and the total number of eggs and the number of egg-masses laid were rather less than in the case of *D. melanoderes*. At 25°C. [77°F.] and almost 100 per cent. relative humidity, 84·6 per cent. of the eggs of *D. nigrofasciatus* and 93·5 per cent. of those of *D. melanoderes* hatched. At 30°C. [86°F.], only 9·1 per cent. of the eggs of *D. nigrofasciatus* hatched at 100 per cent. humidity and none at 72 per cent. The egg stage of this species at approximately 100 per cent. humidity lasted 5·2 days at 30°C. and 6·4 days at 25°C. Observations on the temperature at the surface of the bare soil at Bambesa in January 1939 indicated that conditions there are not favourable for incubation, since the temperature exceeded 30°C. for at least five hours a day over more than half the month and often exceeded the figure [108·6°F.] shown by Pearson to be fatal [**27** 491]. At 25°C. and high humidity the development of *D. nigrofasciatus* was completed in 34 days and that of *D. melanoderes* in 36. The nymphal instars of both species are described. Observations on the longevity of adult males and females gave maximum periods of 164 and 160 days for *D. nigrofasciatus* and 205 and 201 days for *D. melanoderes*.

Prabhas Kumar Mitra. **A Note on *Heliothis armigera* Hubn., as a Pest of Pea (*Pisum sativum*).**—*Curr. Sci.* **13** no. 12 pp. 312–313, 4 refs. Bangalore, 1944.

Larvae of *Heliothis armigera*, Hb., were found in pea pods in local markets in Bengal and reared in the laboratory. They were abundant in January–February 1944. They pupated in February–March, and the pupal stage lasted 8–12 days. Other Lepidopterous larvae found in the pods were *Cosmolyce* (*Polyommatus*) *boetica*, L., in December–February and *Etiella zinckenella*, Treitschke, in February–March, the latter in sufficient numbers to be regarded as a major pest.

Papers noticed by Title only.

Notley (F. B.). **Locusts** [including notes on the organization of control campaigns in Somalia]. [*In English and Italian.*]—8, 10 pp. [Mogadishu] Chief Administ. Somalia [1944].

Thompson (W. R.). Ed. **A Catalogue of the Parasites and Predators of Insect Pests. Section I. Parasite Host Catalogue. Part 4. Parasites of the Hymenoptera, Isopoda and Isoptera. Part 5. Parasites of the Lepidoptera (A-CH).**—10¾ × 8¼ ins., v + 130, v + 130 pp. multigraph. Belleville, Ont., Imp. Parasite Serv., 1944. Price $ (Canad.) 2 each. (Also obtainable from Imp. agric. Bur., 2 Queen Anne's Gate Bldgs., London, price 10*s.* each.) [*Cf. R.A.E.*, A **32** 106, 256.]

Fawcett (H. S.). **Fungus and bacterial Diseases of Insects as Factors in Biological Control** [a review of the literature].—*Bot. Rev.* **10** no. 6 pp. 327–348, 90 refs. Lancaster, Pa., 1944.

Lubatti (O. F.). **Determination of Fumigants. XIV. Residual Ethylene Oxide in Wheat.** Lubatti (O. F.) & Harrison (A.). **XV. Determination of Trichloroacetonitrile and Methyl Bromide.** Lubatti (O. F.). **XVI. Sorption of Hydrogen Cyanide by Wheat.** Lubatti (O. F.) & Harrison (A.). **XVII. Comparison of the Sorption of Hydrogen Cyanide, Ethylene Oxide, Trichloroacetonitrile and Methyl Bromide by Wheat.**—*J. Soc. chem. Ind.* **63** pp. 133–139, 3 figs., 3 graphs, 10 refs., pp. 140–144, 3 figs., 17 refs., pp. 257–268, 3 figs., 9 graphs, 21 refs., pp. 353–359, 5 graphs, 14 refs. London, 1944.

Cassil (C. C.) & Hansen (J. W.). **Colorimetric Analysis of Xanthone Spray Residues.**—*Industr. Engng Chem.* Anal. Edn. **16** pp. 35–37, 2 graphs, 1 ref. Easton, Pa., 1944.

NOTICES

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Director.

The Annual Subscription, *in advance*, to the Review, Series A (Agricultural), is 30s. post free ; Series B (Medical and Veterinary), 15s. post free. Subscriptions to the *current* Volume received after 30th June in each year will be charged at the published price, *viz.*: Series A, 36s. ; Series B, 18s. Prices of Back Volumes on application.

Orders and Subscriptions should be sent to the Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS.

	PAGE
AFRICA, EAST : Locusts and their Control in Somalia (*Title only*) ...	128
AFRICA, SOUTH : Insect Pests in S. Rhodesia in 1942 and 1943	126
AFRICA, WEST : Investigations on *Dysdercus* spp. in Belgian Congo ...	127
ARGENTINA : Chalcidoid Parasites of Insects on Peach	117
ARGENTINA : Past and proposed Work on biological Control	117
BRITISH ISLES : Temperature Reactions and Surface Movement of Wireworms	123
CANADA : Infestation of Flax by *Cephus cinctus*	98
HAWAII : A new Eriophyid on Litchee	111
INDIA : Lepidoptera infesting Peas in Bengal	128
SPAIN : Liberation of *Trichogramma* spp. against *Cydia pomonella* ...	125
SWITZERLAND : Work on Orchard and other Pests in 1940–42	124
U.S.A. : Sprays against *Scirtothrips citri* in California	97
U.S.A. : Reviews of recent Investigations on Insecticides	98, 99
U.S.A. : Substitutes for previously used Insecticides	100
U.S.A. : The Influence of the War on Plant Quarantine	100
U.S.A. : Insects affecting Vegetable Seed Crops	100
U.S.A. : Insect Problems of Field-crop Seed Production	101
U.S.A. : Protection of processed Foods and Seeds from Insect Damage...	102
U.S.A. : Greenhouse Tests of Resistance of Wheat to *Mayetiola destructor*	103
U.S.A. : Insects affecting *Parthenium argentatum* in California	104
U.S.A. : Mass Liberation of Parasites against *Cydia molesta*	105
U.S.A. : *Collops* spp. destroying *Macrosiphum onobrychis*, etc., in Utah	106
U.S.A. : Observations on *Leptocoris trivittatus*	106
U.S.A. : The Distribution of Lepismids injurious in Houses	106
U.S.A. : The Establishment of *Habrolepis rouxi* in California	107
U.S.A. : Damage to Pines by *Aphrophora saratogensis*	107
U.S.A. : Soil Treatments against Larvae of *Cydia pomonella*	108
U.S.A. : Experiments with *Pseudococcus comstocki* and Parasites of other Mealybugs	109
U.S.A. : Hyperparasitism of *Pseudococcus comstocki* in Virginia	109
U.S.A. : Fumigation of Elm Wood against *Hylastes rufipes*	110
U.S.A. : Quarantine Regulations against Insect Pests	111
U.S.A. : New Species of Eriophyids	111
U.S.A. : *Plusia brassicae* as a Pest of Lettuce in Arizona	112
U.S.A. : Lepidoptera attacking Orange Fruits in California	113
U.S.A. : Experiments with DDT against *Aonidiella aurantii*	113
U.S.A. : The Nature and Extent of Damage by *Anabrus simplex* ...	113
U.S.A. : *Crambus hayliellus* damaging Carpet Grass in Florida	115
U.S.A. : Investigations on *Diatraea saccharalis* in Florida...	116
WEST INDIES : Insect Pests in Porto Rico in 1941–42	97
WEST INDIES : Introduced Coccinellids on Mona Island	110
WEST INDIES : A Cryptocephalid attacking Oranges in Cuba	116
Recent Research on Insecticidal Aerosols	99
Recirculation in Fumigation of Commodities	103
Diapause in the parasitic Hymenoptera	105
Toxicity of Ricinine and related Compounds to *Cydia pomonella* ...	106
Tests of N-substituted Benzamides against *Cydia pomonella*	107
Apparatus for studying Deposition and Retention of Sprays	116
Papers on Pests of Fruits, Vines and Ornamental Plants	117–120
Papers on Pests of Vegetable and Field Crops	120–122
A Catalogue of Parasites of Insect Pests (*Title only*)	128
Diseases of Insects as Factors in Biological Control (*Title only*)	128
The Determination of Fumigants (*Titles only*)	128
Analysis of Xanthone Spray Residues (*Title only*)	128
LEGISLATION : Quarantine Regulations against Insect Pests in U.S.A.	111
LEGISLATION : A Summary of a Plant Quarantine in India	111

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE
by the South Essex Recorders, Ltd., Ilford.

(236) Wt. P6/3752 5/45 S.E.R. Ltd. Gp. 432.